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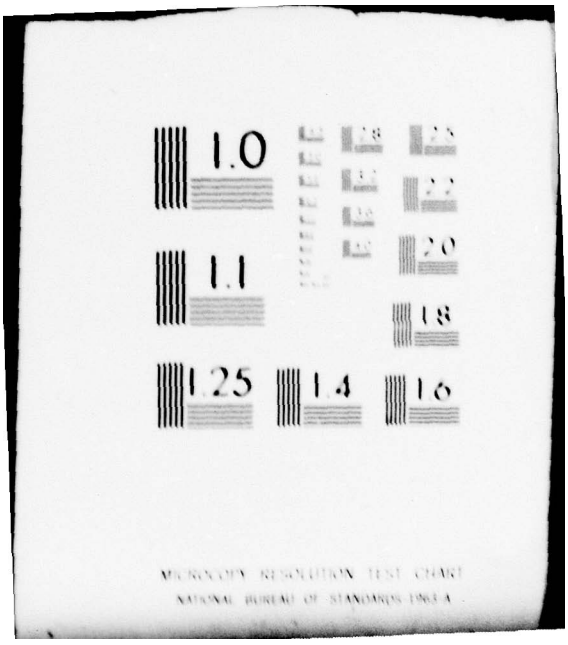
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THESIS

PROVISIONING RESPONSIBILITIES, PROCEDURES, AND REQUIREMENTS DETERMINATION IN THE UNITED STATES MARINE CORPS

by

Paul Melvin Lee, Jr.

September 1979

Thesis Advisor: A. W. McMasters

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Provisioning Responsibilities, Procedures, and Requirements Determination in the United States Marine Corps

by

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Submitted in partial fulfillment of the requirements for the degree of

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ABSTRACT

The United States Marine Corps spends 32 million dollars annually for the initial provisioning support of new weapon systems. This support is vital to the performance of new equipment during the initial period of operation. This thesis contains a summary of the current responsibilities and procedures for determining initial support in the Marine Corps. It also addresses such issues as level of repair analysis, provisioning technical documentation, phased provisioning, contractor provided initial support, and combat essentiality. Recommendations are made for additional investigation in the following areas; the augmentation of provisioning project teams, the formation of an ad hoc provisioning review board, the scheduling of provisioning review conferences, the elimination of excess stocks, and the contracting out of initial support.

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I. INTRODUCTION

A. OVERVIEW

The Marine Corps spends over $30 million annually to obtain repair parts to keep new equipments operating during their initial period of use [15]. The process of obtaining these parts is referred to as initial provisioning. The principle objective of initial provisioning is to ensure that items required to support and maintain a new end item will be available at the right time, in the right place, and in the right quantity.

The Commandant of the Marine Corps is responsible for provisioning policies and principles. Application of the policies and principles and responsibility for determining the types and quantities of items required and for procuring and stocking those items so that they will be available when, where, and in the quantity needed, is the duty of the Marine Corps Logistics Base, Atlantic (MCLBA), Albany, Georgia.

Provisioning involves considerable risk and uncertainty. Since equipment being introduced is for the most part new, estimates of the performance of parts must be based on past experience with similar parts and on engineering and maintenance judgments. Underestimates can be adjusted as usage experience is obtained, but not without an impact on equipment readiness. Overestimates, on the other hand, produce excessive quantities of spares in the supply system which may never be

needed. Therefore, both understocking and overstocking influence the performance and cost of a new weapon system.

The first job in provisioning is to establish the framework of supply support through the development of a maintenance concept. Meetings between contractor and Marine Corps personnel are held to establish the framework and to consider the support concept. Eventually, the process turns to the selection of spare parts. In order to make appropriate, accurate decisions, the Marine Corps purchases data and drawings from each contractor describing in detail the spare and repair parts. It is from this data and other pertinent information that a judgement is made of a quantity needed to initially support the end item. In addition, cataloging is achieved and source maintenance and recoverability coding assigned. These classify items for such things as field repair, depot level maintenance, and so on. The process is complicated and relies almost entirely on estimates and judgement.

Once the data has been accumulated and evaluated, the computations are made and spare parts orders are generated. MCLBA must then monitor the receipt of the requisitioned items until release of the project by the Commandant of the Marine Corps to field using units. Thereafter, the normal supply channels and support functions are responsible for end item performance.

B. SCOPE AND PURPOSE

This thesis investigates the current procedures applicable to initial provisioning in the Marine Corps. More specifically,

the discussion focuses on the provisioning process; parts selection and requirements determination; and important issues in provisioning. The intent of this report is to describe, analyze, and make appropriate recommendations for improvement of initial provisioning in the Marine Corps. It is also envisioned that this thesis will serve as a guide to support personnel and users in understanding the provisioning concepts utilized by the Marine Corps.

C. ORGANIZATION OF THE THESIS

This thesis contains six chapters. Chapter One has introduced the provisioning concept and outlined the scope and purpose of the thesis. It also describes the organization of the report and provides a summary of the research method employed.

Chapter Two formally defines Department of Defense (DOD) and Marine Corps provisioning objectives and policies. The responsibilities of each vital party in the provisioning environment are introduced. Additionally, the main elements of Marine Corps provisioning are presented and diagrammed to highlight the process.

Chapter Three narrows in on the methods and rationale for selection of parts. It also presents the models used in the calculation of the quantity of spare and repair parts to be added to system stock, initial allowance quantities, and pre-positioned war reserves. Particular emphasis is made regarding

the uncertainty of the computations and the inherent risks involved when usage data is not available upon which to compute requirements.

Chapter Four identifies level of repair analysis; provisioning technical documentation; special consideration items; phased provisioning; contractor provided initial support; and follow-up and feedback as important provisioning issues. The issues raise important questions regarding the efficiency and effectiveness of Marine Corps provisioning.*

Chapter Five discusses the points raised and conclusions drawn from the research performed in the writing of this thesis. The provisioning process is characterized herein as a control system possessing seven elements. The seven elements are used as a vehicle for giving structure and order to the conclusions and a medium for assessment of the success of the provisioning process as a functioning control system.

Chapter Six recommends six areas where more intensive study could help achieve a better provisioning effort. Along with the recommendation for additional investigation into the six key areas, specific recommendations are made in each category for consideration. As a result of the nature of this thesis, the recommendations are aimed at improving the

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*Efficiency herein is defined as the ratio of outputs to inputs, or the amount output per unit of input whereas effectiveness describes the relationship between outputs and objectives. [1].

management control, planning, and requirements determination for a provisioning program. It is envisioned that implementation of each recommendation will result in a more cost-effective method of provisioning and significantly reduce the total life cycle cost for the provisioned item.

Finally, Appendix A and Appendix B provide a glossary of key terms and a list of acronyms which are relevant to the provisioning process and are used throughout this treatise. The remaining appendices present models essential to a better understanding of the material presented.

D. METHODOLOGY

The methodology involved an exhaustive library search of current literature on initial provisioning, a review of current Department of Defense and Marine Corps orders and directives, and telephone conversations with provisioning and systems personnel at MCLBA. Specifically, the intent of the research was to discover commonalities in provisioning approaches and problems in all of the DOD service components and then to identify the specific functions in Marine Corps initial support procedures that could be improved. The approach, although analytical, was not quantitative. During the investigation, it was hypothesized that better planning and management control would improve the Marine Corps provisioning process. As a result, particular emphasis was placed on describing and analyzing the provisioning process and requirements determination procedure.

II. PROVISIONING OBJECTIVES AND POLICIES

A. DEPARTMENT OF DEFENSE POLICY

The Department of Defense (DOD) establishes the basic objectives and policies for the determination of initial requirements in peacetime for secondary item spare and repair parts in Department of Defense Instruction 4140.42 of August 7, 1974. This instruction encompasses all spare and repair parts in support of end items of material acquired by DOD components for which a maintenance capability is anticipated [18]. However, spare aircraft engines which are covered in DOD Instruction 4230.4 and design controlled cryptologic items are not included.

The intent of DOD I 4140.42 is to promulgate methods and policies that will optimize initial supply support during the demand development period of a weapon system within available resources. Specifically, the instruction identifies four events that must take place during the development of initial requirements. The events include the development of program data for initial requirements determination; initial requirements computation policy; basis for initial stockage; and the demand development period computation policy [18].

DOD I 4140.42 modifies the traditional inventory determinants of requirements objective and requisitioning objective in order to hedge against the probability of over-stockage. Therefore, the mathematical models identified in the instruction

cover the range and depth of stockage at the wholesale and retail levels, but avoid the use of the variable safety levels and economic order quantities because of the uncertainty associated with new estimates.

The range and depth of war reserves are not considered in this policy.

At the wholesale level, every new item is reviewed against a DOD standard for stockage based upon a forecast of twelve months demands. For demand-based items, a probabilistic approach is used to compare the expected cost of stocking an item to that cost to be incurred by not stocking the item and subsequently needing it. Included in the nonstockage cost is an implied shortage cost attributable to delay in satisfying demand. Items for which the nonstockage cost is equal to or exceeds the stockage cost are stocked as demand-based at the wholesale level. Items for which the stockage cost exceeds the nonstockage cost are not stocked at the wholesale level as demand-based.

All items with insurance codes are stocked in minimum quantities.* Items which do not meet the insurance item criteria for wholesale level stockage may be stocked in the wholesale system only if there is an over-riding requirement

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*Insurance items are defined as having occasional intermittent demands but not sufficiently repetitive so as to warrant classification as a stocked item. However, because of the essentiality of the item to the readiness of the weapon system or because of the lead time required to obtain it, prudence dictates stocking the item.

to do so based upon their essentiality to a selected weapon system. In this instance, an item will be stocked as a Numeric Stockage Objective (NSO) item.

At the retail level, those rules normally applied by each concerned DOD component in the determination of qualification for stockage as a demand-based item, for items already in the DOD supply system, are also applied to the initial demand estimate for new items [18].

During the demand development period (DDP), DOD components are required to give special management attention to newly provisioned items so as to release restrictions placed on initial requirements computations. The restrictions and the use of estimated requirements factors are gradually relaxed after the first six months and then dropped completely by the end of DDP.

Each military component is also required to maintain a two-year demand history file of part numbered and not held stock numbered items requisitioned at the wholesale level. The purpose of this file is to identify items for review and possible stockage which may later meet stockage criteria as the result of actual demand.

It is also suggested that procurement and deliveries be time-phased to conform to deployment schedules. This reduces holding inventory cost and facilitates the receipt and issue of initial support items immediately upon delivery. Also there is less record keeping and less of an opportunity for pilferage, destruction, or loss.

After an item has been in an operational environment for two years, the use of the estimated requirements factors is prohibited; actual demand data is to be used. There are two exceptions to this general rule. First, if a spare or repair part has had no demand during the two year DDP, the estimated requirements and assets remain unchanged. The second condition results when an engineering or design change invalidates past demand. Items with high reliability are to be protected "with a minimum economic retention level equal to all on hand assets for all active items during the period of POC + 4 years." [18]*

B. UNITED STATES MARINE CORPS POLICY

The Marine Corps defines provisioning as:

> the actions required to identify, select, procure, and properly position in the appropriate segments of the supply system and maintenance echelons, the range and depth of repair parts, tools, and test equipment, and publications required to support an item of equipment until full responsibility can be assumed by the supply system through routine replenishment.

The basic Marine Corps policy on provisioning is contained in the Marine Corps Provisioning Manual of 2 July 1976 (MCO P4400.79c). The manual also assigns explicit responsibilities in the provisioning process to Headquarters Marine Corps (CMC), the Marine Corps Logistics Base, Atlantic, (MCLBA),

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*POC is the attainment of the capability for equipment or systems to be used by operational units. It is preliminary to and in support of the achievement of an Initial Operational Capability.

the Active Forces, Marine Corps Posts and Stations, and the Marine Corps Reserve.

The objective of the manual is to promote the goal of efficient, effective provisioning within budget constraints, and in compliance with direction from higher authority. Efficient and effective provisioning requires a dedicated, experienced work force using the latest mathematical methods and electronic data processing equipment. To achieve efficacy also means initiating planning early in the weapon system acquisition process and assuring that all initial support items required for initial issue, initial war reserve, and initial system stock of Marine Corps managed items are available and in a protected status prior to the established ready-for-issue date.

The provisioning process is complex and commences at any phase in the system acquisition process, depending on the type of acquisition program. Regardless of the initiating point, the principal provisioning functions focus on early funding estimates for budgetary planning; the actual selection, requirements determination and acquisition of support items when the end item goes into production; and the distribution of the support items to field using and supporting organizations. The process terminates when the end items are placed in service [25].

The significant aspect of the process is that many activities are being planned and executed simultaneously. This is particularly true of the budget. The DOD budget requirements

necessitate early costing of programs. As the provisioning process progresses, budget estimates are refined and funds appointed for acquisition of the support items.

As a first step in understanding the provisioning process, the responsibilities of each integral part should be addressed. Then the process can be described and understood based on the functions and roles assumed by each element.

C. RESPONSIBILITIES

1. Headquarters Marine Corps

The Commandant of the Marine Corps is responsible for provisioning policy. General provisioning guidance, coordination information, and evaluation are furnished as required to MCLBA and field units.

Headquarters responds to requests for guidance and representation at conferences from MCLBA and other services and agencies of the government. Representatives from CMC are usually invited for pre-provisioning and provisioning conferences held by MCLBA. These conferences produce the documentation and parts requirements peculiar to the provisioning process.

The funding and direction relative to Procurement Marine Corps (PCM) appropriations, for initial issue to the active duty Fleet Marine Forces (FMF), originates at Headquarters. A PMC allotment is regularly provided to MCLBA to finance initial stockage levels and issues.

Headquarters is involved in the coordination of all interservice agreements arising from the provisioning efforts

at MCLBA. The applicable cross-service agreement is included in all end item military inter-departmental purchase requests (MIPR's) and Marine Corps purchasing requests (MCPR's) sent to other military services. Headquarters also monitors procurement documents for end items that are managed by the Defense Logistics Agency (DLA) and the General Services Administration (GSA).

Headquarters provides MCLBA with a PMC shopping list each year. This list notifies MCLBA that certain end items are to be procured during the current fiscal year and budget year. This report is the first indication that research and development work has been successful and that the Marine Corps plans to introduce a new system. The following information is furnished in conjunction with the PMC shopping list data for the preparation of budget estimates:

1. Total quantity to be procured.
2. Maximum support quantity.
3. Planned in-use quantity.
4. Marine Corps organizations which will employ the equipment and the quantity to be employed by each organization.
5. Life expectancy.
6. Standardization status.
7. What equipment is to be replaced, if any.
8. Quantity of new end items requiring drawdown initial issue.
9. End item essentiality (combat-essential, mission support, critical low density, etc.).

Headquarters establishes a Provisioning Performance Evaluation Program to ensure that adequate initial supply support is provided at minimum cost, minimizing contributions to non-requisitioning objective excesses at the end of the demand development period (DDP). The program employes the weapon system code (WSC) to monitor usage against a specific application.

2. Marine Corps Logistics Base, Atlantic (MCLBA)

MCLBA, in the traditional definition of the term, manages the Marine Corps' provisioning program. The functions performed by MCLBA are detailed in MCO P4400.79c. However, the primary functions are conducting meetings; developing schedules and procedures; obtaining, monitoring, and reviewing data and documentation; collecting, collating, and evaluating essential empirical data; assignment of key codes; and the determination of the range and quantity of initial stockage items.

MCLBA hosts the pre-provisioning and provisioning team conferences when the Marine Corps is the integrated material manager. During the course of a weapon system acquisition, MCLBA is expected to conduct those meetings and conferences required to achieve the following provisioning goals:

1) Predicting a need

2) Establishing the organizational level of the need

3) Facilitating the level and fixing the length of use before replacement is required

4) Funding and acquiring the appropriate item.

The primary product of a pre-provisioning conference is a provisioning performance schedule (PPS). The PPS provides milestones for the contractor and the Marine Corps in the completion of the provisioning support concept. In addition to PPS, MCLBA develops schedules and procedures as necessary for supply support requests. These procedures are necessary to ensure that material from DLA, GSA, and the weapons integrated materiel manager (WIMM) are in the Marine Corps Supply System prior to the planned ready-for-issue date. Also, adequate forewarning enables the WIMM to respond to FMF replenishment requirements.

After preparation of the Provisioning Technical Documentation (PTD) by the contractor MCLBA reviews and updates the information for accuracy, currency, and relevancy. The receipt of the documentation signals the convening of the provisioning team conference where the range and depth of parts required to support an end item are determined. When program support date is altered, MCLBA is tasked with updating the files and documentation. Item identification data is also collected to assure the positive identification of the item and of other military users to facilitate utilization of existing DOD assets in lieu of a new procurement. Only items recommended by the contractor as support items or selected by MCLBA as a result of the provisioning process are submitted to the Defense Logistics Support Center (DLSC) for screening and identification.

The provisioning manual lists the empirical data which should be collected, evaluated, and stored because of its significance in requirements determination. MCLBA takes appropriate action on these elements:

(1) Procurement lead time
    (a) Administrative lead time
    (b) Production lead time

(2) Fourth Echelon secondary reparable repair data

(3) Fifth Echelon secondary reparable repair data

(4) Order and shipping time
    (a) User continental United States (Conus) and overseas
    (b) Service Battalion, 1st Marine Brigade--Conus and Overseas
    (c) Force Service Support Group--Conus and Overseas

(5) Peacetime and combat maintenance replacement rates
    (a) Combat and peacetime failure factors
    (b) Maintenance replacement rates
    (c) Repair rates
    (d) Repair cycle time
    (e) Order shipping time
    (f) Washout rates
    (g) Economic repair (batch) quantity
    (h) Time in repair
    (i) Repair interval

(6) Source, maintenance, and recoverability codes (SMRC)

(7) Criticality Codes

(8) Resupply rates

The order emphasizes the need for review and validation because of the key role the factors play in the range and depth decision.

Having completed all the preliminary functions identified above, MCLBA determines the stockage levels required to

support the end items of equipment. The requirements computations are performed by automatic data processing equipment. Each provision item order (PIO) generated by the computations is reviewed by a provisioner at MCLBA before procurement is initiated. When the dollar value of the PIO's exceeds funding limitations and additional PMC ceiling is needed, CMC is advised.

3. Field Units

The active forces identify, receive, and release initial issues. Once an end item is placed in service, the force commanders notify CMC and MCLBA. During the two-year demand development period, the active forces are expected to protect the initial issue quantity from excess or disposal. The active forces are also authorized to requisition initial garrison operating and war reserves for a replenishment end item when the replenishment end item is a different make or model from the one originally authorized or when there has been an increase in end item allowance where initial issue was not made.

Marine Corps Posts and Stations and the Marine Corps Reserve budget for replenishment of garrison operating stocks. The 4th Marine Division/Wing/Team (DWT) units' (reserve units) initial war reserve parts are budgeted for and procured with Procurement Marine Corps (PMC) or Stock Fund Account (SFA) monies.*

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*The Marine Corps expresses planned requirements anticipated to be needed in a given year in terms of PMC and SFA dollars. These figures represent the expected cost of the provisioning effort.

The War Reserve parts for the fourth DWT are held in the stores system as protected stock.

4. Summary

The list of functions to be performed by the various elements in the provisioning cycle are long. The length emphasizes the difficulty of controlling and coordinating the provisioning process. Moreover, when a multifaceted task is complicated by technical considerations and budget constraints the process becomes even more complex.

D. U.S. MARINE CORPS PROVISIONING PROCESS

The provisioning process is iterative. The reviews and recalculations characterize the system from initial funding to the in-service date. The immediate objective of the provisioning process is funding. From the moment that MCLBA is notified of the introduction of a new item of equipment or of a major modification to an existing weapon system, funding requirements are denoted. The efforts in this regard initiate the planning phase of provisioning.

The process needs to be reinforced continuously with relevant data. A pre-provisioning conference is scheduled with contractors to develop a provisioning schedule and to discuss the requirements for provisioning documentation. The contractors then prepare the documents. The documents specify the range and depth of items required for the initial fill of each of the activities and maintenance echelons. Provisioning personnel screen these documents and tailor the recommendations

to the funding limitations and mission requirements of the Marine Corps. None of the contractor recommendations are accepted without review. The intensity of the review is related to the value of the program.

Once the provisioning documents are accepted, the implementation phase of the process begins. Implementation involves the selection and item requirements determination for initial support and the placing of the item in service. The factors influencing initial requirements determination are provided in Table 2.1. The Table identifies the determinants by functional area [11].

Requirements are generated in the form of PIO's. PIO's are requests for procurement of items. The provisioner will screen the PIO's and make any necessary adjustments before the orders are released. In addition to the PIO's, MCLBA prepares allowance lists and other maintenance and supply publications.

The final stage in the process is the placing of the item in service. Close coordination and control are required at this phase to assure that the authorized range and depth of initial stockage levels are available for the planned ready-for-issue date, that the parts are received by the Marine Corps using units, and that initial issue repair parts are released concurrently with shipment of the end item, or in advance of the end item shipment to ensure receipt of initial issues by the date the end items are received.

TABLE 2.1

Factors Influencing Initial Requirements Determination

FUNCTIONAL AREA	INPUT DETERMINANTS
1. USER	Operating Programs Environment Deployment Requirements Manning Levels Readiness Requirements
2. RDT&E	Test Reports Engineering Estimates Engineering Change Proposals Technical Data Design and Configuration
3. CONTRACTOR	Procurement Lead Times Production Schedules Provisioning Technical Documentation Specifications and Standards Performance Schedule
4. SUPPLY (MCLBA)	Stockage Objectives Replenishment Pipeline Times Inventory Management Packing, Packaging, & Preservation Allowances Requisitioning Objective Cataloging Stock Lists Inventory Objectives
5. MAINTENANCE	Program and Policies Resources and Facilities Source Coding Repair Cycles Replacement Factors Failure Data and Factors Equipment Modification Economic Recoverability Capabilities Personnel Training
6. PROCUREMENT AND CONTRACT ADMINISTRATION	Contracting Pricing Sources Capability Proposals

1. Planning

Upon receipt of the Marine Corps Five Year Defense Program (FYDP) document from Headquarters, Marine Corps at MCLBA, the provisioning process begins. The FYDP alerts MCLBA of CMC's intent to phase out a current system or to introduce a new system that is expected to improve the Marine Corps military posture.

Each year CMC provides MCLBA with the PMC Planning Execution Shopping List. The list is a summary of the end items approved for procurement during the current fiscal year and budget year. With this information, MCLBA begins to gather additional data that forms the basis for the PMC/SFA Provisioning Financial Plan. This plan contains a current explanation of the basis for all provisioning estimates. Naturally, at this point the financial plan is a cost estimate based on historical data and intuition as to what initial support will cost for a particular item.

Headquarters Marine Corps continues to provide information regarding the status of specific new items as it becomes available to MCLBA. A Letter of Adoption and Procurement, "LAP Letter" accelerates provisioning planning. The LAP advises MCLBA of the latest end item allowances replacement factors, life expectancy, planned phase-in of new items and phase out of replaced items, and key maintenance factors. The LAP fortifies information received informally or provided in preceding documents. Prior to actually formalizing and

publishing of the LAP, CMC submits proposed LAPs to MCLBA for review and comment.

The latest changes to CMC planning data are published in the Field Budget Guidance (FBG) and Provisioning Guidance Data (PGD). FBG and PGD consist of such things as end item purchases, the number of units each organization is to receive, echelon of maintenance to be performed by each organization, and schedules of phase-in and phase-out which the provisioner needs to do his job. The planning information furnished by these reports facilitates the loading of data elements into the computerized provisioning files. At a later date, this information coupled with additional data from the contractor will extricate the computation of parts requirements based on math model formulae. It will also generate part orders and print technical, maintenance, and supply catalogs as well as reports used by all levels of management.

Once a contract is awarded, provisioning planning accelerates. The Marine Corps develops a provisioning plan even if the Marine Corps is not the end item manager. In these cases where an item is management coded to the DSA, GSA, or another service, the Marine Corps' requirements will be submitted to the appropriate WIMM on supply support requests. Therefore, the Marine Corps remains active in provisioning regardless of who the WIMM is.

2. Preprovisioning Conference

The first procedural milestone in the provisioning process is the convening of a preprovisioning conference. The

meeting is held as soon as practical after contract award and before full production of the end item begins. On contracts where the Marine Corps is the WIMM the conference is held at MCLBA. Personnel attending this conference include a provisioner, an equipment coordinator, a cataloger, an illustrator, CMC representatives, DLSC representatives, the contracting officer, and the contractor. In cases of inter-service type support the conference would be held at the other military service's installation. The same personnel from the Marine Corps listed above would attend.

The principal purpose of the preprovisioning conference is to define technical documentation requirements and to establish a schedule for the submission of these data. Obviously, the contractor should provide representation qualified to discuss all areas, have the authority to commit the contractor, and the authority to sign a provisioning performance schedule in the contractor's behalf. The contractor usually sends professional, highly paid, experienced people to these conferences.

Military specification MIL-P-17993 (MC), or appropriate cross service agreements, require that a contractor or government service provide provisioning technical documentation (PTD). The documentation requirements are cited in TABLE 2.2 [24]. The requirements for PTD are reflected in the "Contract Data Requirements Lists" (DD-1423) and are attached as exhibits to the procurement document. The DD-1423 forms contain the specific elements of data to be supplied under a contract or

TABLE 2.2

USMC Provisioning Technical Documentation Requirements

(Numeric Value Shown Indicates the Quantity Required)

		Long Leadtime Items List Pkg	Sample Prov Tech Doc Pkg	Prov Tech Doc Pkg	Supplementary Prov Tech Doc Pkg	Revision Prov Tech Doc Pkg	SF Prov Tech Doc Pkg	SF Revision Prov Tech Doc Pkg	SF Supplementary Prov Tech Doc Pkg
a	Long Lead Items List	2							
b	Provisioning List		2	2		2			
c	Provisioning Screening Cards	1	1	1		1	1	1	
d	Engineering Drawing Cards	2	2	2		2	2	2	
e	Tabulating Cards	1	1	1		1	1	1	
f	Item Identification				2				2
g	Illustrations		2	2	2	2			
h	Drawings	1/	1/	1/		1/	1/	1/	
i	Short Form Provisioning List						2	2	
j	Contractor Std Commercial Manual						2	2	
k	Common and Bulk Items List		2	2		2			
l	Contractors Specifications-Standards			2/					
m	Contractors Specifications-Materials			2/					
n	Provisioning List Outline Draft		1						

1/ Optional (In lieu of EDC - when authorized by USMC)

2/ If Available

a Military Interservice Purchase Request (MIPR). Also, the quantity and type of PTD as shown in TABLE 2.2 may vary in accordance with the requirements in DD-1423 of the contract or MIPR.

When the Marine Corps is obtaining a new equipment and its related support from another military service or a defense supply center, three distinct conditions exist which require different technical documentation. Under the first condition, the Marine Corps is obtaining the end item from another service. Subsequently, the Marine Corps must be provided the PTD that the other service used in order to select the Marine Corps' spare parts support. Condition two occurs when the Marine Corps and another service are procuring end items simultaneously as contractual co-claimants. The range of documentation will be in accordance with both of the procuring activities' provisioning specifications. The third condition arises when the end item is for Marine Corps use only, but is being procured by another service from a commercial source. PTD here will be provided in accordance with Marine Corps specifications.

Two kinds of input data are considered in the development of PTD. The first kind of data is spares technical data. It describes the characteristics of each individual spare part and is developed by the manufacturer as he designs and tests the end item. The second kind of data is program data or program environmental data. It describes the maintenance and

operations programs and represents general policy constraints for the contractor.

Depending upon the complexity of the end item being provisioned, the time lapse from the preprovisioning or guidance conference to the in-service date may be from two to five years. For example, a piece of commercial off-the-shelf test equipment where no first article test or approval is necessary may easily be provisioned and be in service in two years. Conversely, a new radar set which does require first article test and may require several engineering change proposals during the full scale development and production phase, can take as long as five years to complete provisioning and to place the end item in service [23].

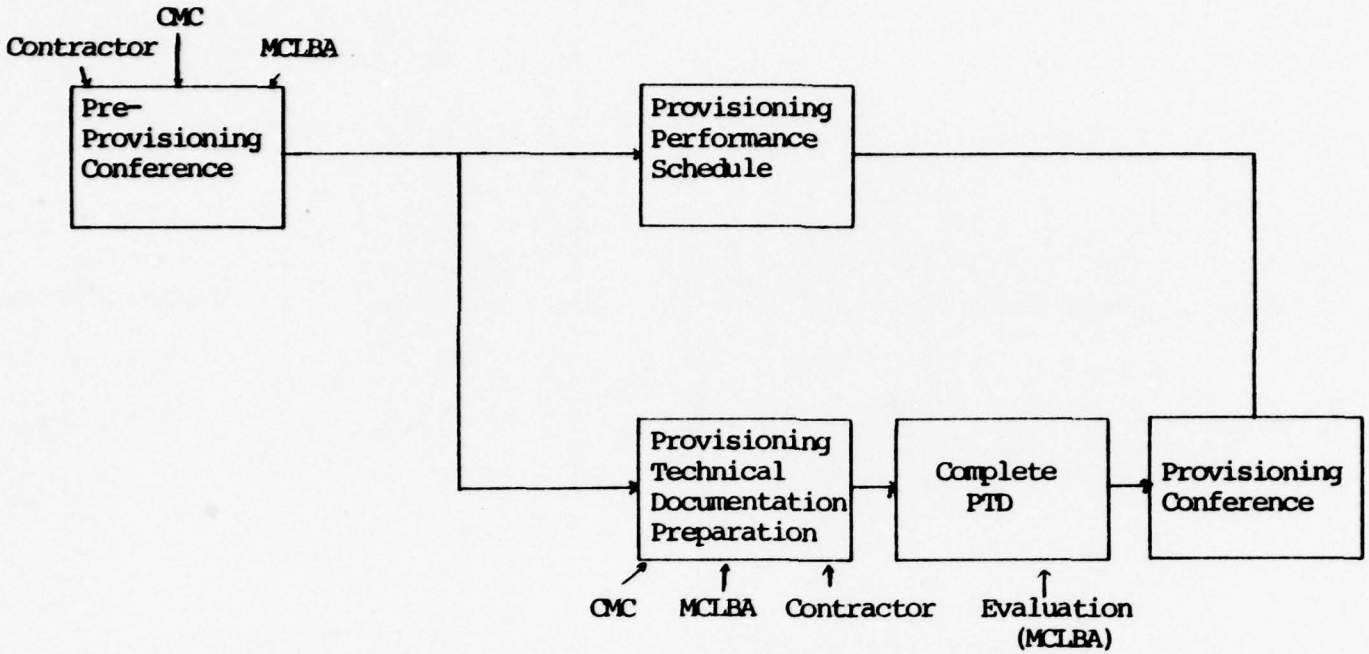
After completion of the documentation, it is forwarded to the provisioning activity for review and evaluation. The technical evaluation of the proposals is most thorough at this point. If it is acceptable to technicians and provisioners, final plans are made for a provisioning conference. The accepted PTD is loaded to the Marine Corps provisioning subsystem HØ1 file with the date shown in the file being the date of PTD acceptance. The information the documentation contains is the realization of the efforts of all elements in a weapon system acquisition.

The PPS after it is finalized at the guidance conference, becomes part of the end item contract. The PPS lists every event that will occur in the process and the date it is to be completed. A change to the PPS requires the concurrence of

both the provisioning activity and the contractor. Although the Marine Corps is dedicated to a fixed schedule, changes are commonplace. Figure 2.1 identifies the key inputs and outputs of the first milestone in the provisioning process. The acceptance of the PTD and the scheduling of the provisioning conference completes the planning phase of the process.

3. Provisioning Conference

A provisioning conference is normally held within thirty days after receipt of the acceptable documentation. This next milestone is held at the contractor's facility so that the Marine Corps can get a good look at the equipment. Contractor personnel qualified to discuss the technical aspects are available to answer questions. The provisioning conference is convened to select the parts required to support the end items. Using his knowledge of the structure of the Fleet Marine Forces (FMF) and the echelons of maintenance performed by each organization, the provisioner assigns SMR codes to each individual part listed in the provisioning list (PL). The assignment of SMR's involves intuitive judgement, experience, and analysis. It is a technical decision which considers the design, manufacture, application, maintenance, supply practices, and capabilities, as they relate to each support item and the operational assignment of the end item. Additionally, item identification requirements are established and cognizant inventory managers for items selected are identified by the Marine Corps' cataloging representative at the conference.



Flowchart of the First Milestones in the Provisioning Process from the Preprovisioning Conference until the Provisioning Conference

FIGURE 2.1

By the time the provisioner returns from the provisioning conference, all the relevant data (SMR code, criticality code, replacement factors) needed to select and generate initial stockage requirements are available. Once the data is loaded to a repair parts file, PIO's are created and national stock number (NSN) requirements are engendered for all maintenance significant parts. MCLBA will attain the needed NSN's from DLSC and they will be loaded to the repair parts file.

The final stages of the provisioning process involve printing of allowance lists, supply lists (SL-3 and SL-4), technical publications and maintenance publications. At the same time, the attainment and receipt of repair parts is being monitored. To effectively monitor a provisioning program, MCLBA assigns a provisioning project number and schedule for all end item procurements. When sufficient parts have been received to support the new equipment and all publications are available the equipment is ready for issue.

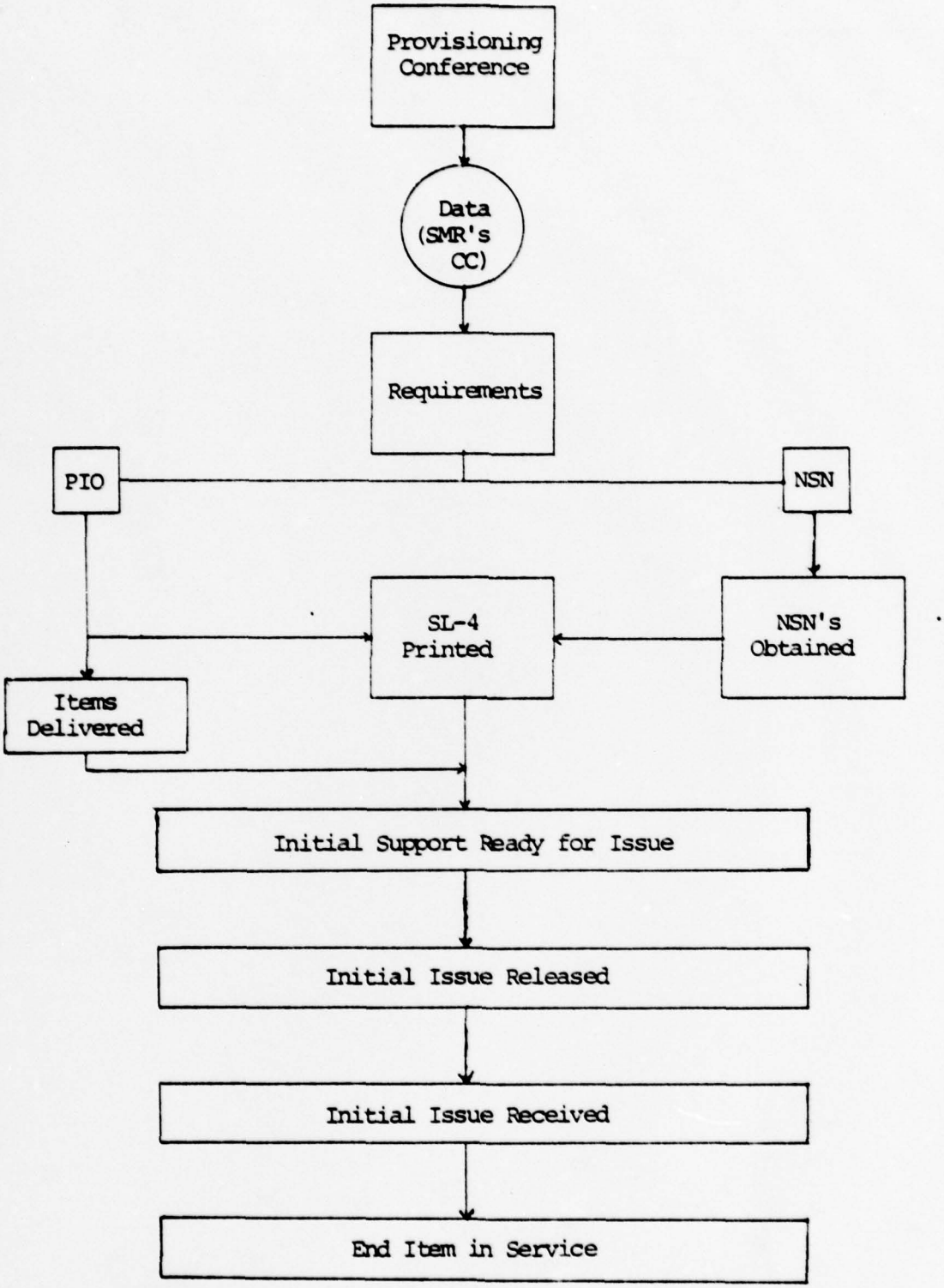
CMC authorizes the release of a provisioning project after MCLBA has reported it to be ready for issue. The initial issue for field units consists of consumable and repairable repair parts required for initial garrison operating and mount out stocks, supply publications (SL-3 and SL-4), and special tools. Initial provisioning actions cease when a force commander has reported receipt of one hundred percent peculiar repair parts and mount out requirements of repair parts; and has placed the end item in service.

Figure 2.2 is a flow chart of the process from the provisioning conference until the termination of provisioning responsibility when the end item is in service.

E. SUMMARY

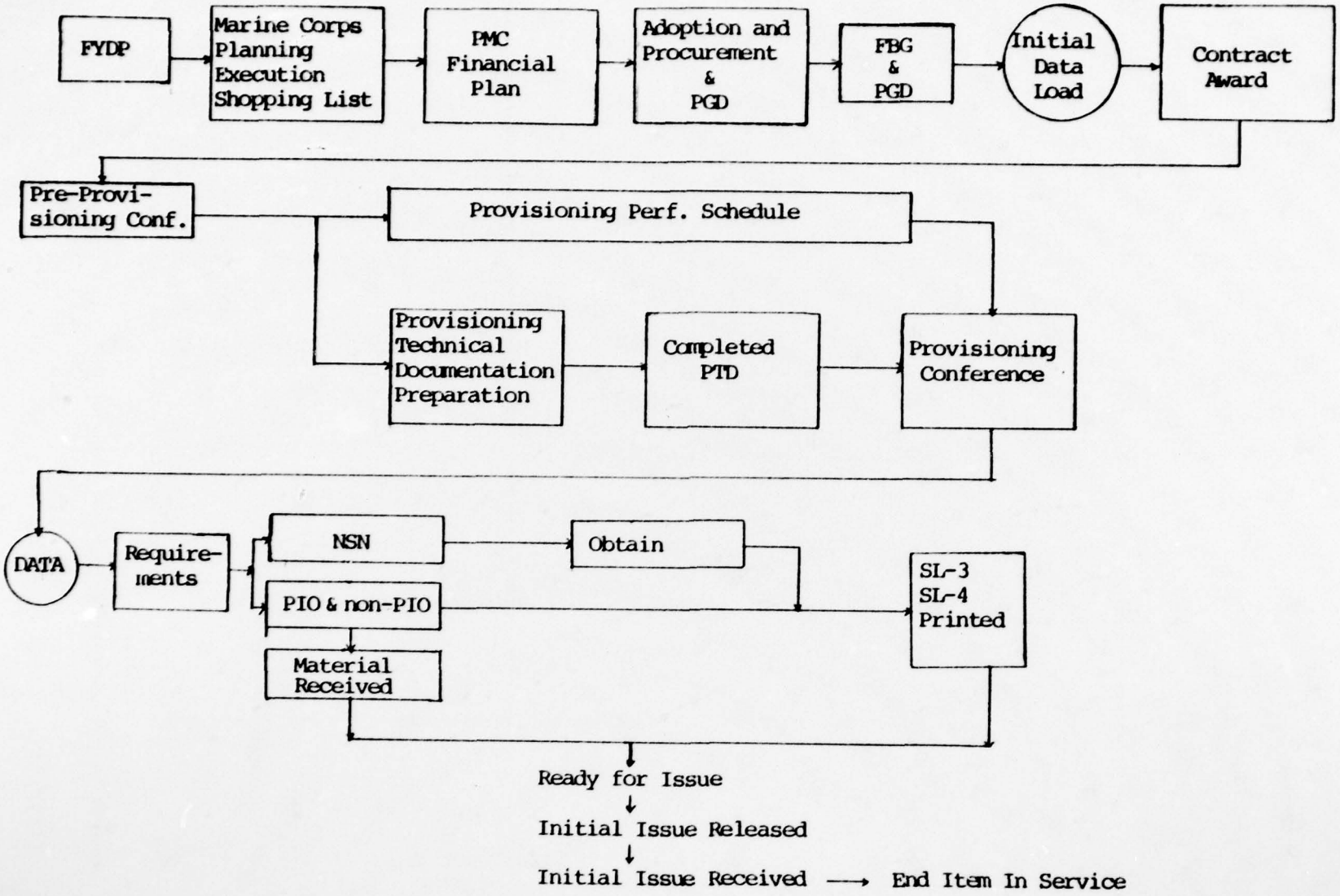
Figure 2.3 consolidates into one flow diagram the Marine Corps provisioning process as presented in this chapter. The process has been described as complex and relying heavily on automated data processing equipment and mathematical models. However, the infusion of the intuitive judgement of the provisioner and the opportunity for management involvement characterizes provisioning more as an art than a science. It is not unusual for a provisioner to change the initial requirements generated from the computer calculations before provisioned items orders are released and allowance lists produced [15].

The second major point of this chapter is that the success of a provisioning project hinges upon quality input data, comprehensive planning, and program implementation. For this reason, data is checked and rechecked for admissability, and the budget is estimated and re-estimated before final apportionment.



Flowchart of Key Events from the Provisioning Conference Until the End Item is Placed in Service

FIGURE 2.2



Flowchart on the Provisioning Process

FIGURE 2.3

III. SELECTION AND COMPUTATION OF INITIAL REQUIREMENTS

A. SELECTION OF PARTS BY MCLBA

The selection of spare and repair parts begins immediately after notification that a new item is being procured for introduction into the Marine Corps. Planning and guidance documentation from CMC, and the structure of the Marine Corps support and maintenance organizations serve as a major guide in the initial identification of spare and repair parts and test equipment. Special consideration is given to parts which are essential to the operation of combat essential end items. Insurance items also receive special attention in the selection procedures. The contractor and maintenance engineers use test performance data and their experience and intuition in identifying combat essential and insurance parts. No formal decision model is used, however to assist in the decision to include an item in this cateogry.

1. SMR Codes

The contractor may assign SMR codes and replacement factors during the preparation of a provisioning list as required by MCLBA. At a provisioning conference held within 30 days after receipt of acceptable PTD, MCLBA evaluates and re-assigns SMR codes and then makes final determination. Personal experience, the use of existing codes for similar items, knowledge of the Marine Corps maintenance and supply structure and a screening of technical files provide the basis for the

final assignments. The SMR codes indicate to maintenance and supply personnel the manner of acquiring items for the maintenance of equipment; the maintenance levels authorized to remove, replace, repair, assemble, manufacture, and dispose of support items; and the reclamation or disposition action required for items which are removed and replaced during maintenance [25]. Table 3.1 provides the SMR Code Format [25].

In Table 3.2, the numerous elements of the SMR code are listed and briefly described [25]. By combining the elements, the SMR code is formed and maintenance and supply instructions are communicated to the various logistic support levels and using commands. These codes are made available to their intended users by means of technical publications, such as allowance lists, illustrated parts breakdown manuals, maintenance manuals, and supply documents. Ten typical SMR code assignments are listed below:

1. PAOZZ
2. PAFZZ
3. PBHZZ
4. PADZZ
5. PAFHH
6. PCFDD
7. PAFFF
8. PAHHH
9. PADDD
10. PAHDL

Therefore, a part coded as PAOZZ (number 1 above) would imply that it is to be procured and stocked for anticipated or known usage by the Marine Corps. Secondly, units having first and second echelon maintenance capability (organizational) are authorized to remove, replace, and use the item.

Source Codes		Maintenance Codes			
(1)	(2)	(3)	(4)	(5)	(6)
Means of acquiring support item		Use Lowest maintenance level authorized to remove, replace, and use the item	Repair Indicates whether the item is to be repaired and identifies the lowest level of maintenance with the capability to perform complete repair; i.e., all authorized maintenance functions	Recoverability Code Indicates disposition of item	Reserved for Service Operation Reserved for internal management purposes of each service

SMR Code Format

TABLE 3.1

1. SOURCE CODES

PA- Item procured and stocked for anticipated or known usage.
PB- Item procured and stocked for insurance purposes.
PC- A PA item that is deteriorative in nature.
PD- Support item, excluding support equipment, procured for initial issue or outfitting.
PE- Support equipment procured and stocked for initial issue or outfitting to specified maintenance repair activities.
PF- Support equipment, not stocked, but certainly procured on demand.
PG- Item procured and stocked for sustained support of the life of the equipment.

2. MAINTENANCE CODES

O- First and Second Echelon
F- Third Echelon
H- Fourth Echelon
D- Depot (Fifth) Echelon

3. RECOVERABILITY CODES

O- First and Second Echelon Dispose.
A- Item Requires Special Handling.
D- Return To Depot.
F- Third Echelon Dispose.
H- Fourth Echelon Dispose.
L- Repair, Condemnation is not authorized below the depot/Special Repair Activity level.
Z- Non-repairable, dispose of by activity in Column 3 of SMR.

SMR Code Assignments

TABLE 3.2

And third that this item is not repairable and may be disposed of by a unit with an organizational maintenance capability.

2. Criticality Codes

The criticality code restricts the range of repair parts. Repair parts assigned criticality code 1 or 3 by a provisioner are authorized for inclusion in garrison operating levels, mount-out, and system stock. A criticality code of 1 means the end item cannot perform its intended function without the part, while a 3 means the part is required for the safety of personnel. A criticality code assignment of 4 authorizes garrison operating levels and system stock. Criticality code 2 items are authorized for system stock only.

3. Item Inventory Manager

An essential step in the selection of spare and repair parts for inclusion in an initial issue package is the identification of the appropriate item manager.

The concept of integrated material management for items in the DOD inventories requisites a thorough search of DLSC technical data records to determine the appropriate manager and method of obtaining cataloging/supply support. The screening at DLSC is usually initiated by the contractor. The contractor will provide DLSC a list containing the total range of part numbers and manufacturers identification numbers which comprise the end item. Subsequently, DLSC searches its files crossing the identification numbers to federal stock numbers. Three conditions arise pursuant to the match, (1) the item is identified to another integrated manager, (2) the Marine Corps

is identified as the integrated manager, and (3) there is no integrated item manager recorded for the item.

Following the provisioning conference, MCLBA will submit supply support requests for weapons system oriented consumable items which are item management coded to an integrated materiel manager. This procedure is necessary to ensure that DSA, GSA, or WIMM managed items required for initial issue and war reserve are available in the supply system prior to the planned ready-for-issue-date.

Items which are Marine Corps managed, and combat essential or insurance coded (those with a source code of PB in the SMR code) are reviewed and considered for stockage.

New items which have no identifiable inventory manager are researched and classified to a Federal Class. It is then determined which supply agency manages that class and whether or not the Marine Corps should retain ownership. Once this is decided the Marine Corps will use either a SSR or item manager coding form to alert the agency. The SSR notifies the agency of the Marine Corps' coding and support requirements. The item management coding source document is used to register the Marine Corps as an integrated manager.

B. COMPUTATION OF REQUIREMENTS

1. Introduction

Calculating the quantities of spare and repair parts is risky and uncertain. The guidance provided in DOD I 4140.42 has sophisticated the initial computation process, however, it

has not removed the uncertainties. It is difficult to be accurate, when there are so many variables influencing the computational outcome. Critics abound who cite initial provisioning, shortages and over-calculations, exploding them to unreasonable proportion.

The initial requirements are computed after selection of the range of spare and repair parts. The basic model that the Marine Corps uses for initial requirements determination of repair parts is derived from DOD I 4140.42 and is comprised of 36 formulas and over 100 variables. The formulas were developed to calculate the number of spares (reparables) and repair parts (consumables) needed to support an end item during the data development period (DDP). A basic assumption of the model is that DDP is to last a maximum of two years.

The 36 formulas are based on a standard provisioning requirements equation. The equation states that a quantity (Q) of spare or repair parts is the product of a replacement or replacement factor per end item per year (A), times the number of such parts contained in an end item (B), times the number of end items supported (C), and times a support time interval (D). The basic equation therefore, has the following form:

$$Q = A \times B \times C \times D$$

Some of the more common variables found in the formulas include production lead time, authorized day level, repair rate,

repair cycle time and peacetime/combat replacement factor. The formulas are grouped into those applicable to system stock, initial allowance quantity, and prepositioned war reserve (PWR) computations. The 36 variations in the basic model stress the scope and complexity of the provisioning requirements effort.

2. Requirement Categories

As previously mentioned the Marine Corps identifies three general categories for requirements computations of initial system stock, initial allowance quantity, and pre-positioned war reserves. System stock strata consists of a procurement cycle safety level quantity (PC/SL) and the procurement cycle lead time quantity (PCLT). The initial allowance quantity (IAQ) contains a garrison operating level (GOL) and a mount out level (M/O). The prepositioned war reserve strata (PWR) has material for the active forces and all requirements for the inactive mobilization forces (4th Division/ Wing Team).

3. Initial System Stock

The levels of initial system stock for Marine Corps managed items vary depending on the provisioning project, procurement lead time, washout (failure) rates (RSR), and whether an item is new to or is established within the Marine Corps Supply System. The computed quantities for system stock must support the entire density of end items in service until actual demands have been generated to establish a routine replenishment rate. The provisioning requirements objective

for the initial system stock levels of consumable and repairable parts is equal to the procurement cycle/safety level quantity plus the procurement cycle lead time quantity.

The first step in the computation of initial system stockage levels is the development of program data. Utilizing the completion schedule in Part I of the LAP letter, a provisioner is able to approximate an initial program forecast period (PFP) for the provisioning of the initial system stock. The PFP is smoothed for demand forecasting into a time weighted average months program (TWAMP). The TWAMP is the average number of monthly operational units of a program through a program time base. Appendix C provides the formulas for TWAMP and an example of a TWAMP computation [18].

The TWAMP value is used to compute a PC/SL quantity and a PCLT quantity. The sum of these two quantities is the provisioning requirements objective (PRO) for an initial stockage level. Formulas used in the calculation of a PRO for both consumable and repairable parts are demonstrated in Appendix D [25]. The authorized day levels of supply utilized in the computations are cited in Appendix E [25].

After a provisioning requirements objective is computed for consumable repair parts and repairables using the TWAMP, appropriate procurement cycle/safety level quantity day levels, and procurement lead time requirements, a check is made to determine whether the item should be stocked as demand based. The Marine Corps screens all new Marine Corps managed system requirements through the COSDIF cost equation developed in

DOD I 4140.42. The COSDIF technique compares the expected cost of stocking an item to the expected cost of not stocking it and needing it. If the latter is higher than the former the item is stocked. Appendix F sets forth the basic COSDIF model [18].

FORTRAN operating rules apply in solving the COSDIF equation on electronic data processing equipment. The Marine Corps does not possess the capability to use FORTRAN job computer language, therefore the stockage tables produced from application of the equation are printed for the Marine Corps by the Assistant Secretary of Defense Installations and Logistics. The Marine Corps used the tables to construct a tailored provisioning decision matrix furnished in Appendix G [24]. This matrix incorporates the COSDIF cost to hold, cost to buy constraint. Items surviving a screening using the matrix are authorized for wholesale level stockage in the Marine Corps.

Items identified as insurance items during the selection process also qualify for stockage under the criteria for demand based, and are recognized by the matrix. Because the insurance items are necessary to prevent the degraded operational capability of a weapon system, these items are stocked in quantities of minimum replacement units (MRU) as designated in the PTD.

A second category of non-demand-based items that is stocked are NSO items. For these items a failure rate can be predicted, however, the probability of demand is so low that

they fail to meet stockage criteria. If the lack of a replacement item would seriously hamper the operational capability of a weapon or weapons system, the provisioner may recommend stocking the item as non-demand-based.

All requirements which pass the screening required by DOD I 4140.42 are funded by CMC. The Provisioning Financial Plan is updated to reflect any changes that the requirements determination process has generated. Throughout the process, the objective of the Marine Corps is the reduction of inventory investment at the wholesale level in the determination of initial requirements by restricting the range of items stocked yet minimizing the impact on gross availability and response time by using the results of the restrictive rule, COSDIF, in the decision matrix.

4. Initial Allowance Quantity

An initial allowance quantity (IAQ) is the range and quantity of repair parts required for stockage at the using and support unit levels. IAQ consists of a garrison operating level and a mount out level. The GOL is issued to initially support equipment during peacetime operations. The M/O is issued to be utilized when an organization is committed to combat.

Prescribed day levels of initial garrison operating stock authorized to Marine Corps Forces and support units are intended as days of consumption based on the number of end items employed or supported. The predicted consumption is a function of the estimated days elapsed between initiation of

stock replenishment action and the receipt of the item. Initial GOL's do not include safety levels and are requisitioned on an item by item basis at the start of the DDP. Day levels are estimated during the initial computation of GOL for the fourth echelon support units. Once average order and shipping times have been calculated the total initial GOL authorized a Marine Amphibious Force will be based on the cumulative order and shipping times between all echelons. This procedure applies directly to consumable items in GOL.

In order to reduce periods of inoperability for combat essential low density equipment, fourth echelon support units are authorized one of any consumable critical repair parts which may need replacement in a year. This policy has contributed to the overstockage of consumable items at the retail level.

Two recent developments could counter this trend. First, the introduction of an integrated maintenance management system which will provide real time data for parametric estimating. Secondly, the institution of a "pull" instead of "push" system of provisioning at the fourth echelon level of maintenance [14]. The push procedure would disestablish the stocking of initial issue parts at the retail levels of support. All authorized initial allowance quantities would be held at the wholesale level of support and issued on an "as required" basis. The trade-off in this instance balances readiness and operational effectiveness against the costs of holding inventory.

The mount out level stocks of consumable parts are expressed as sixty days of combat consumption and are not based on order and shipping time. To determine the mount out quantity authorized to using and third/fourth echelon support organizations the following general equation is used: [25]

$$\text{Mount Out Quantity} = A \times B \times C \times \frac{60 \text{ days}}{360 \text{ days}}$$

The variables are identified in the same manner as the general formula shown in Section B.1 of this chapter.

The mount out quantity represents a segment of the total prepositioned war reserve material stocks (PWRMS) issued to the active forces. For those equipments meeting combat essential low density criteria, one each of any critical repair part will be authorized in the highest fourth echelon support units' mount out stock. Parts in this category are stocked as NSO items.

All initial repairable items are positioned in maintenance floats. The GOL stocks are separated at each float from the mount out assets. To arrive at the requirements for GOL and M/O items, separate criteria are used. Five variables are crucial in the reparable requirements computations: maintenance replacement rate, repair rate, resupply rate, repair cycle time, and failure rate.

The failure rate is an estimate of failures which will be experienced during a given time interval. The failure rate is derived from in-house estimates and from the PTD provided

by the contractor. Since the Marine Corps procures failure data, it would be beneficial to check the contractors' method for determining failure rates and to have him document test results at the provisioning conference. All failure rates and maintenance rates whether computed in-house or by a contractor are thoroughly reviewed and evaluated prior to requirements determination [24].

Appendix H provides the equations used to determine initial allowance quantities of consumable and repairable items [25].

6. Prepositioned War Reserve

This strata consists of the PWR supplies for the active forces and all requirements for the inactive mobilization forces (4th Division/Wing Team). The PWR assets for the active forces are stored at Albany, Georgia and Barstow, California and are available when required. Upon activation, the PWR assets for the inactive forces are issued. The central management of these levels facilitates control by the Marine Corps stores system.

The PWR quantity of consumables is calculated by first determining the total of PWR and mount out and then subtracting the mount out requirement from the PWRMS. The equation for PWRMS is: [16]

$$\text{PWRMS} = A \times B \times C \times \frac{\text{support period in days}}{360 \text{ days}}$$

The calculations for PWR repairables is similar, however, partial quantities are determined prior to the final stock level quantity. Appendix I lists the formulas used in the automated computation of PWR and the specific conditions for application of each [26].

D. SUMMARY

One of the most important areas in provisioning is computing the range and quantity of repair parts. Although mathematical models have been developed by DOD and the individual military services to compute the initial wholesale and retail level stock quantities, there still remains much risk and uncertainty.

The Department of Defense establishes the basic objectives and policies for initial requirements determination in DOD I 4140.42. Four events are identified as crucial to the development of initial requirements: development of program data for initial requirements determination, initial requirements computation policy, the decision to stock or not to stock at the wholesale level based on guidance provided in enclosure 2 of DOD I 4140.42 and retail level stockage decisions made in accordance with DOD service component developed rules, and the demand development period computation policy. The instruction provides quantitative criteria and models to assist the military service in making better initial provisioning stockage decisions.

The implementation of DOD I 4140.42 and the mechanics of requirements computation are the responsibility of MCLBA in

the Marine Corps. The computation process begins with the selection of parts and proceeds through the individual computation formulas for the initial stockage levels, initial allowance quantity, and prepositioned war reserve quantity.

In spite of the mathematical techniques used to predict demands, overstockage of certain parts and understockage of others continue to characterize the current situation. The reasons for the miscalculations are the absence of historical usage data upon which to base predictions, the complex nature of the weaponry and support systems, the inherent difficulties with provisioning procedures, and the subjective basis for many coding decisions.

IV. PROVISIONING ISSUES

A. BACKGROUND

The discussion to this point on initial provisioning has been directed at the initial issue process and requirements determination. In this chapter, six provisioning issues will be addressed that significantly impact on the provisioning system and the range and depth of spare and repair parts provided an item when it is issued. The six issues are:

(1) level of repair

(2) provisioning technical documentation

(3) special consideration items (SCI)

(4) phased provisioning

(5) contractor provided initial support

(6) follow-up and feedback.

Each issue raises important questions about the efficiency and effectiveness of Marine Corps provisioning. A thorough understanding of each point will highlight the need for additional work in these six vital areas, and will also emphasize the extreme complexity and uncertainty of provisioning.

B. LEVEL OF REPAIR

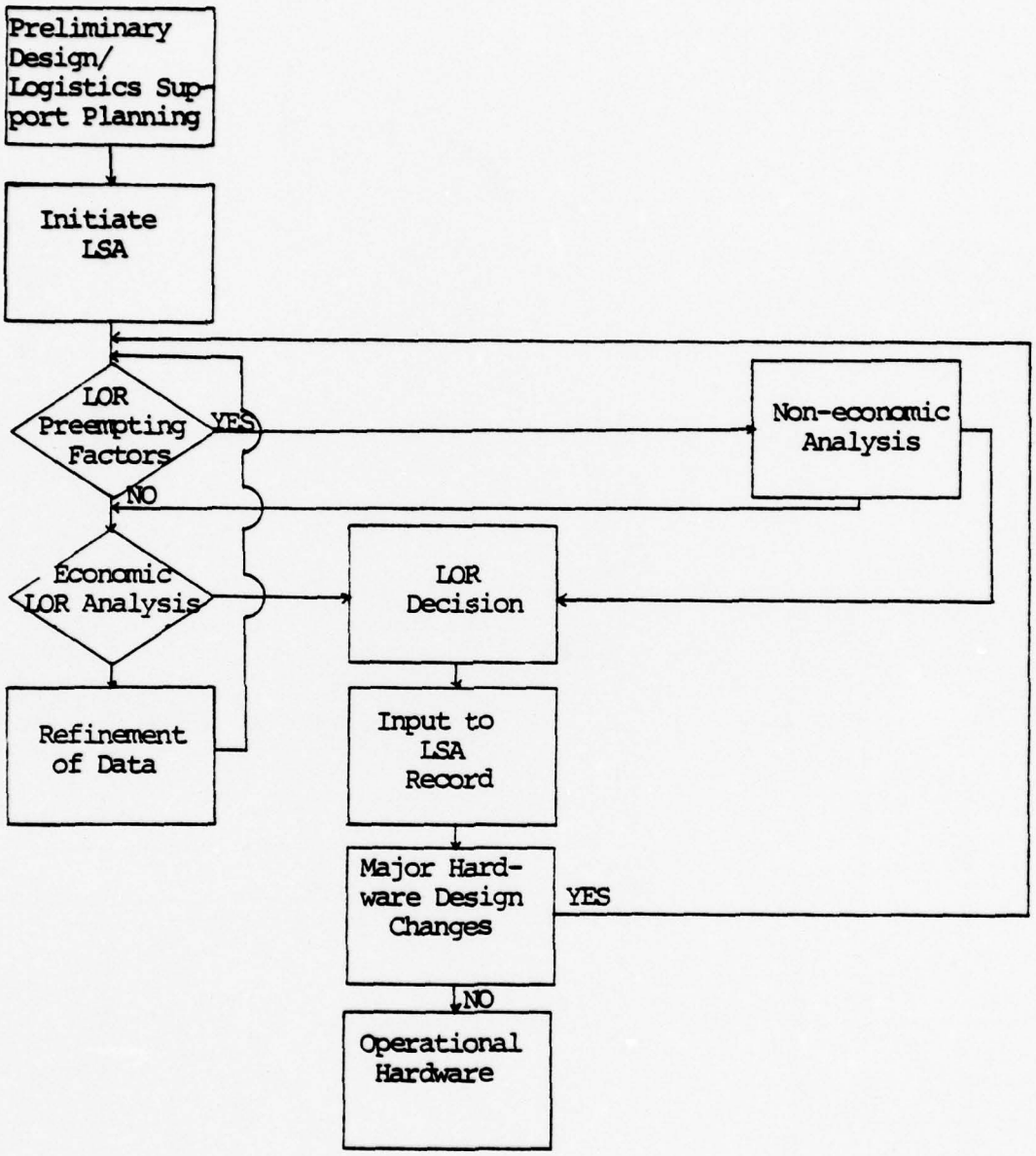
When acquiring a new system or modifying an existing system, logistic decisions must be made which have a significant effect on the operation and support of the end item. These decisions determine the location of repair; the quantity and quality of logistic-support personnel; technical, maintenance,

and supply data required; the range and depth of parts; support and test equipment needed; and the types of facilities that will be required throughout an equipments life cycle. Initially, these decisions are made by the program acquisition manager with the assistance of logistic support personnel. However, these decisions must be continually reviewed for relevancy to the changing operational environment of today's systems.

The integrated logistic support (ILS) principles promulgated in numerous DOD directives and definitized in the decision factors related above emphasize the need for tools to evaluate support alternatives from the standpoint of cost and effectiveness of a weapon system. Level of Repair Analysis (LORA) is one decision process or analytical tool that facilitates the economic evaluation of various alternative logistic concepts.

DOD Directive 4151.16 establishes that a level of repair analysis will be done to assure effective distribution of work among activities [19]. The level of repair is determined by non-economic analysis, economic analysis or a combination of both. Figure 4.1 provides a graphical display of the process [9]. Data gathered and validated during equipment review and testing feed the LOR model.

Non-economic considerations evaluated include the geographical distribution and planned employment of the system in relation to existing organizational structure of supply



LOR Decision Process

FIGURE 4.1

support and maintenance. Some other factors would be safety, repair feasibility, human characteristics, special handling conditions, transportation, and manpower limitations.

After consideration of the non-economic logistic support decision criteria, an economic analysis arrives at the least cost support concept by determining the most economical level of maintenance. Some of the more important items derived from the analysis in addition to reduced maintenance costs are: training cost estimates, labor cost estimates, and consistency to LOR decisions.

MIL-STD-1390 requires a contractor to conduct a level of repair analysis during the development phase of an equipment acquisition. The confidence in the results of the contractor performed LORA depend upon the validity of the input data provided by the Marine Corps. The Marine Corps began developing and testing a Level of Repair Analysis model on 1 January 1979 that will conform with the analytical methodology described in MIL-STD-1390B. Evaluation Research Corporation has been employed to define the Marine Corps LOR requirements, to analyze selected existing LOR models, and to modify one of the selected models or develop a new model [5].

Level of repair has been extensively studied from definition of the decision factors to development of decision rules to be used for source coding. Moreover, the process has had many names such as evaluation of alternative maintenance concepts or source coding [5].

In addition to the application of LORA to life cycle cost evaluations, it can be used as:

(1) an input to maintenance plan decisions

(2) a determinant of the cost effectiveness of proposed engineering proposals (ECPs)

(3) a means of comparing various contractor configuration proposals

(4) a means of comparing special support options

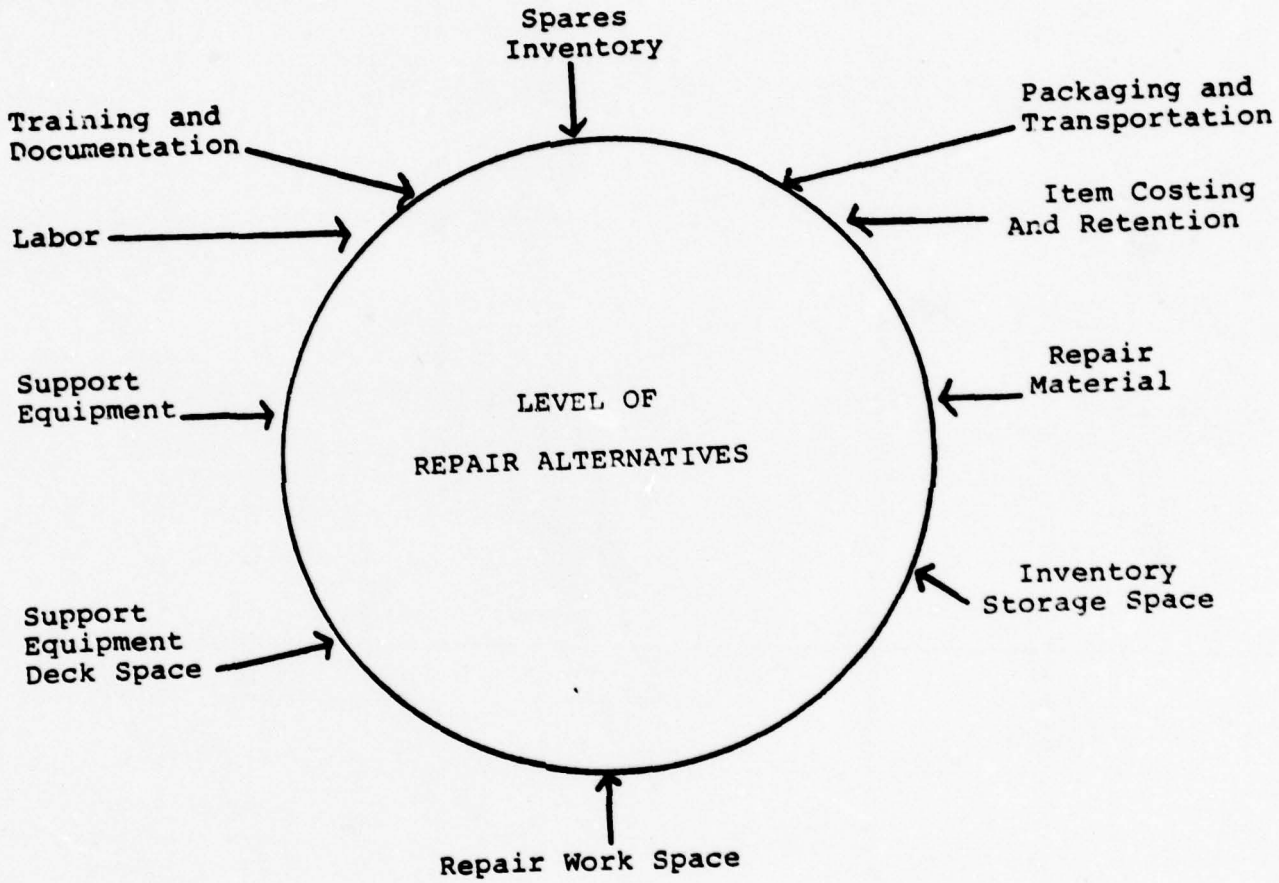
(5) a means of source selection.

1. The Basic AR-60 Model

The Marine Corps uses an economic level of repair screening model called the AR-60 which was developed by the Navy. The AR-60 model establishes an equipment parts hierarchy. It assumes that every system has multiple WRA's (Weapon Replacement Assemblies). The model provides for the repair of WRA's locally by replacement of SRA's. The decision becomes one of determining where to repair the SRA. The alternatives for repair of the SRA's include repair locally, depot repair, contractor repair, or discard. Ten factors are used to evaluate each alternative influencing the economic level of repair decision [7]. Figure 4.2 provides a graphic display of the ten factors.

2. Provisioning Conference

The outputs from the AR-60 model are reviewed at the provisioning conference. This is a shift from the normal purpose of the provisioning conference where affirmation of source codes and discussion of replacement rates are emphasized. The establishment of item identification requirements, and the



LORA Evaluation Factors

FIGURE 4.2

determination of the cognizant inventory manager for items selected are still accomplished, however.

C. PROVISIONING TECHNICAL DOCUMENTATION

To do the provisioning task properly, relevant and accurate data is required. The source of this data is provisioning technical documentation (PTD).

1. The Scope of Provisioning Technical Documentation (PTD)

Provisioning technical data is documented in any one of the following forms: (1) provisioning lists, (2) priced spare parts lists, (3) electronic data processing (EDP) screening cards, and (4) EDP tapes [21]. The scope of provisioning technical documentation requirements for spare and repair parts include the following [21]:

a. Bulk items and common hardware items listing,
b. Long lead items list,
c. Production lists,
d. Vendor items list,
e. Provisioning parts list,
f. Priced spare parts list,
g. Special tools list, and
h. Drawings.

Appendix K provides a breakout of the various data elements provided in the lists cited above. Drawings constitute a special category of PTD which is essential to the engineering, maintenance, and cataloging effort. The requests for drawings are influenced by the cost and specificity which the service component requests of the contractor.

After contract award, provisioning activities define technical documentation requirements and establish a schedule for the submission of the data. Also, agreement is reached as to the content and cost of PTD at this initial meeting. The size, scope, and complexity of an end item, as well as factors such as a program schedule and the method of initial support, may necessitate the submission of PTD be on an incremental basis (progressive provisioning).

The Department of Defense recognized that the preparation of provisioning technical documentation and processing was a bottleneck in achieving timely support and in meeting scheduled in-service dates for end items [21]. To alleviate the problem, instructions were published outlining a uniform method for PTD preparation and processing. However, the problem was only lessened and not remedied. The Marine Corps still has 65 percent of its provisioning projects delayed because of late and inaccurate PTD [14]. When PTD is inaccurate of late, provisioning milestones are slipped or additional personnel resources are used to keep the project on schedule. Late or inaccurate PTD ultimately impacts on the weapon system in-service date, the total cost of the weapon system and the performance of the end item.

The preparation of PTD requires two kinds of data, spares technical data and program environment data.

2. Spares Technical Data

Spares technical data describes the characteristics of each individual spare and repair part. The elements of

technical data include the unit price, the quantity per end item, failure and replacement rates, condemnation rates, the repair capability of each spare at each level of maintenance, and the criticality of the part to the operation of the end item. Usually the weapon system's contractor provides this information since he is familiar with the end item and its components as a result of development and testing.

However, there are other sources for technical data that are seldom utilized. For example, research and development people in the government and in private institutions may be able to provide technical data. Another contractor not associated with this program but having experience in development of similar items or doing research and development in this weapon system category could also provide the information. For projects where a number of components may already be available from industry technical data could be obtained from other services or agencies within the government. Universities and other sources of technical information that do research work could also be tapped.

3. Program Environment Data

The second source in the preparation of provisioning technical documentation is program environment data. Basically, this source defines the service component's intended use for the end item. It also identifies the expected levels of maintenance. The source of this information is the program manager, the functional managers and operating personnel involved in the integrated logistic support planning for the weapon system.

D. SPECIAL CONSIDERATION ITEMS (SCI)

During the item selection phase of the provisioning procedure, special consideration is given to combat essential and insurance, and numeric stockage objective items. Once a part has been identified as falling into one of these classifications, it receives particular attention in subsequent allocation, acquisition, and stockage actions.

1. Combat Essential Items

Although many definitions apply to combat essential items, the basic premise relates the essentiality of a part to the tactical mission of the weapon system of which it is a component. Maintenance engineers identify combat essential parts and insurance items following the development and testing phases of a system acquisition.

The basic factors that determine the combat essentiality of a repair part are urgency, compensability, and mission effectiveness. Urgency suggests the infeasibility of postponing a demand on the supply system if the part fails. Compensability refers to the ability to quick fix, substitute, cannibalize, or locally manufacture the part if it fails. Finally, the question is asked whether mission effectiveness would be adversely affected by the failure of the item under consideration, if so, the item is designated as combat essential.

Combat essential equipment is designated in the LAP and advance logistic data order and is provided in the initial stockage quantity of support items. Special consideration is

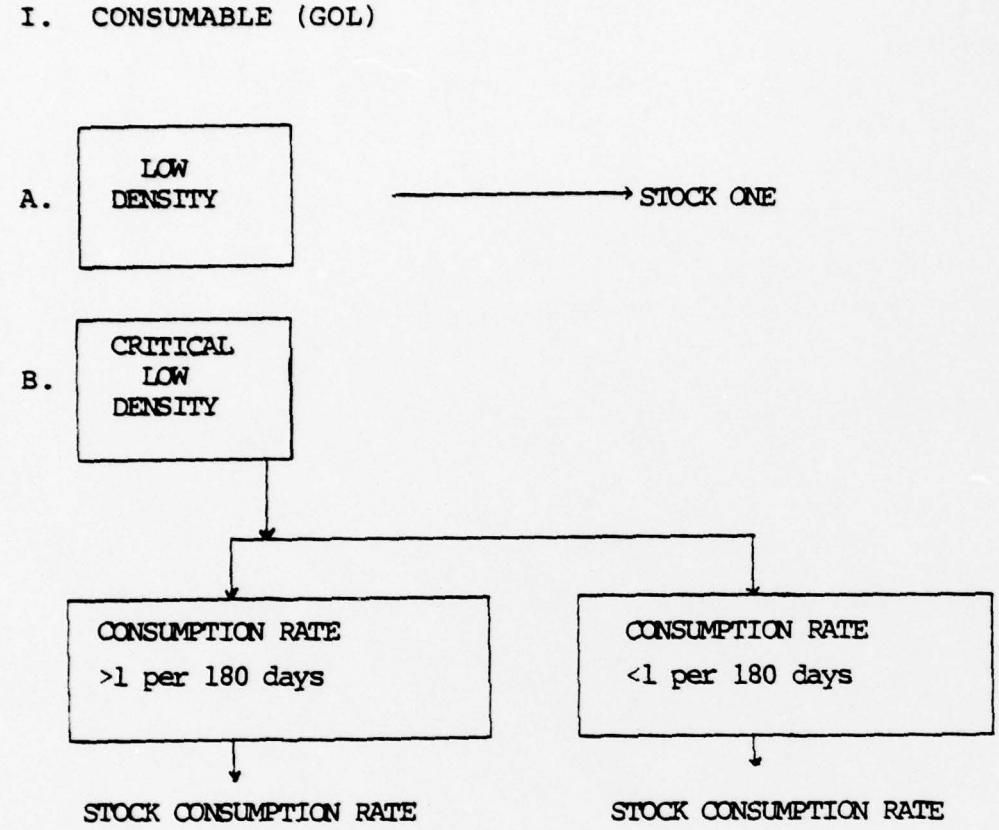
afforded combat essential equipment with densities of 40 or less per division/wing or task organization. Equipment in this cateogry is known as low density. Low density computations are made for all provisioning strata, except the initial system stock category.

Combat essential low density equipment in Marine Corps aircraft wings which require particular management attention are called "critical low density". Using units authorized critical low density end items and their support organizations hold minimum support items designated on a Minimum Stockage List (MSL). MSL allowances are considered mandatory and are the minimum support items required to ensure support of the end item. These allowances are not subject to normal replenishment demand criteria after completion of the demand development period. However, when usage dictates that a level of assets should be increased, additional assets are authorized based on valid item movement and recurring demands.

Figure 4.3 is a matrix of criteria for determining the consumable stockage levels authorized for GOL and PWR low density and critical low density combat essential equipments in the Marine Corps [25].

2. Insurance Type Items

The basic notion of an insurance item is one that is maintenance significant with a life expectancy that would not normally justify its stockage. The provisioning decision for these kinds of parts is most difficult because the major portion of them are low demand items. Overstocking of high demand



Decision Matrix for Consumable (GOL) and War Reserve

FIGURE 4.3

items is self-correcting in a short time; however, this is not the case with low demand items where incorrect stocking decisions impact for a longer time. There is concern that the low demand item will not be used up and will either deteriorate or become obsolete.

Any item with insufficient demand that cannot qualify as a regular stock item may be considered as an insurance item if its essentiality and procurement lead time would ultimately impair the readiness of an end item. The following additional factors bear on the decision to stock or not to stock an insurance item [3]:

- replacement factor for the item
- cost of both initial and replacement items
- cost of end items (unit price) if totally inoperative
- budget constraints or funding available.

A report to the Congress by the Comptroller General in 1972 concluded that the Navy obtained many items for insurance purposes that were not needed. At the time of the review, the repair parts inventory at the Ships Parts Control Center, Mechanicsburg, Pa., consisted of 71,000 line items which had had no usage for two or more years. Over 34,000 of those lines were being carried for insurance purposes [22]. The impact of these statistics is reinforced by the fact that the provisioning process contributes more than 90 percent of the new items to Defense Department inventories [12]. The undeniable conclusion is that the provisioning contributes to the majority

of items being insurance coded and that in most cases, the items are not needed.

The Marine Corps, on 2 June 1979, reviewed its records for items which had had no usage in the last year. As a result of the evaluation, 298,000 line items were deleted from the Marine Corps active inventory file and moved to an inactive file. Over 98 percent of those items removed were spare and repair parts and, of that percentage, nearly 15 percent were found to be insurance coded [17]. This is slightly higher than a survey directed for an Army Inventory Control Point where 13 percent of the items were found to be insurance coded [12]. As a result of this study, the MCLBA is investigating the quantity of insurance coded items still being carried in the active inventory file.

3. Numeric Stockage Objective (NSO) Items

NSO items are those not meeting stockage criteria and not source coded as insurance items, but still essential to total program support because a lack of the item prevents mission accomplishment or causes a safety hazard. Quantities stocked are minimal because little usage is expected. Since NSO items have demand rates, justification for additional quantities is based on deployment of the end item and accumulated usage data.

E. PHASED PROVISIONING

Phased provisioning as described in MIL-STD-1517, June 7, 1971 is a refinement that will assure the timely availability of selected support items and at the same time defer initial

procurement of the full computed quantities of selected items until the provisioning activity can more reliably predict their requirements.

Phased provisioning is a selective management technique applied to new items which are susceptible to premature or excessive procurement through normal provisioning actions. Procurement is therefore deferred for all or at least a part of the initial quantities of selected support items until the later stages of production when operational programs and item configurations have become more stable and actual replacement and maintenance experience data is available. The deferred quantity is maintained as a "buffer stock" within the total production quantity requirements of the contractor pending a final Marine Corps decision. During phased provisioning and while "buffer stocks" are held in reserve, initial support items are held at the appropriate levels of the supply system and maintenance echelons [25].

Headquarters Marine Corps determines the need for phased provisioning and requires quotations from the contractor. The use of phased provisioning applies to complex weapon systems and big cost items that are new or for existing systems undergoing major modification/retrofit.

The contractor recommends phased provisioning for selected items on his provisioning lists; final selection is made by MCLBA in conference with the contractor. The selected items include insurance type items, items that may need design change,

and items having a new or unique design or operating characteristic for which requirements cannot be determined accurately. Records are kept on the items in the "buffer stock" and, on a time phased schedule, a provisioning redetermination of the selected items is held using the latest in-service experience and test data. Redetermination is iterated until the buffer stock is depleted or disposed of. However, final redetermination must occur not later than a lead time in advance of the final production run of the system or end item. This procurement of a portion or all of the initial support requirements for each of the selected items is deferred until application of the latest in-service test and application data; the stabilization of design; and the development of firm operational and maintenance programs, and deployment plans.

Applying phased provisioning under the conditions and situations described below can improve the determination of the range and quantities of items for initial support [20]:

(1) The system or end item of equipment is programmed to be in production by a single contractor for approximately three years or longer.

(2) The program involves quantity production of complex systems or high cost items. Items which are available from off-the-shelf commercial sources are not candidates for phased provisioning.

(3) The systems or end items will have been in operational use, excluding tests, for at least six months prior to the last material ordering point so as to obtain actual usage experience.

(4) Items for which a firm maintenance repair plan is not available and the proportion of depot level repair cannot be determined.

(5) The systems or end items have been placed in production before the design configuration has been stabilized.

(6) The operational and maintenance programs and deployment plans for the system or end items are incomplete, or likely to be changed.

(7) The systems or end items contain items of uncertain maintenance significance, or failure rates cannot be assigned with assurance of accuracy.

(8) Rapid transportation can be economically arranged between the contractor's plant and the points of installation or use of the system or end items while phased provisioning is in effect.

(9) Phased provisioning will not be used in support of research, development, test, and evaluation programs.

F. CONTRACTOR PROVIDED INITIAL SUPPORT

An alternative to service initial issue provisioning is turning the business of total initial spare part support over to the contractor. This seems to be a perfectly logical alternative since requirements are determined by estimates in the initial stages of the provisioning effort and most of the data used for the estimates comes from the weapon system contractor. Assuming the Marine Corps were able to make the contractor responsible for the first year or two of support and then enter the support arena after usage data had become available, the uncertainty of parts supports would all but be eliminated.

Additionally, the contractor would have more flexibility in scheduling production releases for spares along with the end item production quantities. This procedure would also eliminate the need for a separate contract for spares support.

Thus there would be one contract and only one negotiation of price for both end item and spares. The government and the contractor would benefit from the obvious economies [13].

The trend in the Federal Government is to rely more heavily on the private sector. The Office of Management and Budget Circulars A-76 and A-109 highlight the need to use the resources and capabilities of the private sector to lower costs to the various departments of the national government. Moreover, the concept of contracting out services is not new to the Department of Defense. Nearly thirty years ago, the Army Air Corps took the initiative to civilianize functions through the use of contract services. Now, all of the service components in one form or another rely on contracted services to assist them in fulfilling mission and operational commitments in the most affordable way.

Having contractor provided initial support relieves the service component of the responsibility for spare and repair parts determination and its acknowledged costs. However, the service component does lose the flexibility and control of the initial support effort realized by in-house provisioning and pays the added price of the contractor's assumed risk. It is logical to suggest that contractor provided initial support should be considered when buying new weapons systems that are technologically and operationally unproven and in which the risk of requirements determination is very high. Items which have had commercial applications or have had usage in other

military systems should not be considered for contractor support, for the extra cost could be unwarranted.

Once the decision is made that initial support will be contracted out, a contractor's ability to provide provisioning items become a criterion for his selection as the system producer. After selection of a contractor to begin full scale production of a weapon system, the service component must pursue vigilant contract administration to ensure that the support is adequate and that information (usage data) is being accurately gathered for future use by the service component.

Two examples of contractor support that were very successful for the Air Force and the Navy were the C-9A project and the F-4B program. Selection of McDonnel Douglas to produce the C-9A on August 31, 1967 and to have them provide spare parts support reduced organic support costs dramatically [2]. One of the most notable results was an estimated initial savings of about $7 million in spare parts which were stockpiled by the contractor. This figure represented more than 20 percent of the cost of organic support for 5 years [2]. Material support for the F-4B program with McDonnel Aircraft Corporation from May 1958 until June 1963 accrued savings for the Navy in the cost of spare/repair parts support and cataloging [10].

G. FOLLOW-UP AND FEEDBACK

Traditional management theory emphasizes the concepts of planning, implementation, and control. Control of a project

requires that adquate plans be formulated, suitable standards developed, and an information system set up that will enable the project to be compared in terms of expected with actual performance by means of a feedback loop. Corrective action usually follows the comparison in order to get a project to conform with the established goals.

Perhaps the most important aspect of the provisioning process should be to establish a feedback loop that would facilitate evaluation of the provisioning effort and encourage effectiveness in requirements determination. The Department of Defense has not formalized an information system to gather operational data for the correction of initial provisioning quantites. Also the Marine Corps has not attempted to gather information on provisioning performance during the DDP.

In addition to the obvious advantage of correcting inventories through updating demand data and developing new allowances for new order quantities of later buys, the feedback of operational experience would also disclose how the maintenance concept could be altered from that recommended during the pre-provisioning phase. Other results of follow-up and feedback would include identification of training needs for maintenance and user personnel, support equipment use, and deficiencies and errors in publications. Any incorrect applications would also be discovered.

V. DISCUSSION AND CONCLUSION

A. RATIONALE

In this chapter, conclusions will be drawn from research conducted for this report. The technique used will be to identify seven common elements of a control system and to discuss the material hereto presented within each element. This is done for two reasons:

(1) it gives the conclusions structure, order, and cohesion; and

(2) it provides a medium for assessment of the success of the provisioning process as a control system.

B. THE CHARACTERISTICS OF THE PROCESS

Provisioning for a weapon system has been presented as a process with interrelated actions that collectively result in the achievement of a provisioning objective. Therefore the provisioning process may be characterized as a control system possessing seven elements. These elements are [4]:

(1) an objective or function

(2) inputs

(3) outputs

(4) a sequence (a precedence of actions for converting inputs to outputs)

(5) resources, both human and material which assist in the conversion of inputs to outputs

(6) feedback

(7) an environmental setting within which communication can take place with responsible officials to reallocate resources.

1. The Objective

The objective of initial provisioning is succinctly promulgated in Department of Defense Instructions and in Marine Corps Order P 4400.79C. Provisioning aims to support a weapon system with spare and repair parts until demand data can be accumulated and normal supply procedures employed to effect replenishment. In addition to providing the initial outfitting of parts, provisioning also considers support equipment and cataloging. This very general goal of the right parts in the right quantity at the right place requires individual tailored requirements determination for each system or major modification placed in service.

2. The Inputs

The primary input to the provisioning process is data. It is quite clear that detailed data is a major consideration in the development of requirements for initial support. The second input is dollars; millions are budgeted yearly to fund provisioning projects.

Generally, information needed to complete requirements determination is furnished to MCLBA by Headquarters Marine Corps, the weapon systems contractor, and the program manager for the acquisition. Following review and evaluation, the data collectively becomes provisioning technical documentation. PTD must be accurate, relevant, and timely in order to avoid delay in the fielding of a system. Faulty and late PTD annually delays 65 percent of the Marine Corps provisioning projects. The ultimate impact has been to delay 25 percent of the planned in-service dates of Marine Corps weapon systems [15].

Headquarters Marine Corps approves all funding for provisioning. MCLBA estimates funds required to finance the complete initial stockage level of spare and repair parts and furnishes this information to CMC at appropriate times in the budget cycle. This data is provided in the form of Procurement Marine Corps/Stock Fund Account provisioning financial plans which normally contain a detailed explanation of the basis for all provisioning estimates. Dollars are appropriated based on these estimates. The Marine Corps funds 100 percent of the requirements computed as a result of the provisioning range and depth calculations and procedures. This policy emphasizes the Marine Corps commitment to readiness and the operational effectiveness of new end items during the DDP.

3. The Outputs

Outputs from the provisioning process are parts; technical, maintenance, and supply publications; and a concept of supply and maintenance support. A financial plan for the support of a system is also developed. During the DDP, provisioning process output ensures that the system is operable and available when needed. Normally, the initial support period is two years with items originally provisioned being held for four years if no demand is recorded.

In order to guard against the criticism of users and maintenance/supply personnel, when items are not available, provisioners in the Marine Corps have ensured that items are included in initial issue projects by liberally source coding items as either insurance or nonstockage objective. Coding

items in this manner has contributed to the overstockage problem. Unavoidable inaccuracies in computation and judgement only serve to further aggravate this problem. The severity of inaccuracy was highlighted on June 2, 1979 when over 70 percent of the line items in the Marine Corps inventory files were found to have had no activity within the last 12 months.*

4. The Sequence

A series of conferences and a number of computer operations translate the data and funding inputs into viable outputs. The detailed procedures are aimed at reducing the uncertainty of requirements determination. Regardless of the methodology and the exactness of the algorithms developed to assist in provisioning decisions, the process still depends to a large degree on the judgement of the provisioner. His subjective analysis on each project suggests that provisioning is more of an art than a science.

The provisioning process begins with the award of a production contract, proceeds through a pre-provisioning and provisioning conference and culminates with the release of the project. Overlaying these events are a number of planning and reporting milestones which encourage the development of a financial plan and the integration of provisioning into the logistic support concept for a weapon system. This procedure

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*Prior to the execution of a delete program, on June 2 1979, 421,673 line items were resident of the inventory file. 298,000 were dropped from the active inventory after the program execution.

pre-dates the contract award and is initiated in the development of FYDP. As additional information becomes available the FYDP and financial projections are updated. The continuous iterations sensitize the personnel to program changes and keep responsible officials appraised of the project's status.

The entire process of provisioning as delineated by DOD is intended to develop step by step, methodically to its ultimate conclusion. One of the failings of provisioning in the Marine Corps is that there exists no checklist against which events may be evaluated. Moreover, there is no Provisioning Plan which consolidates schedule, cost, and performance criteria in one document thereby enabling the measurement of efficiency and serving as a control device. The late and inaccurate submission of PTD further serves to delay projects and submarine the normal precedence of actions necessary to complete projects.

5. Resources

There are numerous procedural, human, and material resources available with which to achieve effective provisioning. Three methods of constructing provisioning teams allow an activity the opportunity to select the most appropriate one to achieve the initial support objective. Various computation techniques exist which translate provisioning data (maintenance, failure, replacement rates, etc.) into requirements. As a result of the complicated nature of provisioning, many people from numerous functional areas are required to assist in the review, analysis, and evaluation of provisioning information.

To handle the thousands of bits of information, electronic data processing store and process standardized data daily for the Marine Corps.

a. Provisioning Methods

Since it would be impossible for a single individual to possess all the qualifications, experience, and knowledge required to make the necessary selection, maintenance, supply, contracting and cataloging decisions, a team approach to provisioning is the most accepted in DOD, employing personnel from all areas affected by the provisioning process.

The first method is the Resident Provisioning Team (RPT) method and is utilized on selected major system acquisitions. The RPT employs a government team permanently assigned to a contractor facility. The team is skilled in provisioning control, requirements determination, and coding. The second method is the Conference Team Method, which employs government representatives at the contractor's facility but not permanently. Its functions center around the provisioning conference with the members expected to demonstrate the same skills as a resident provisioning team. The final technique of provisioning is the In-House method. In this instance, the government conducts its provisioning effort at its provisioning activity. Generally, this method is used to provision for spares and repair parts that have been in the inventory for some time.

The Marine Corps primarily uses the Conference Team Method. The Marine Corps tailors the team approach to the size and nature of the provisioning project. Thus some

projects will employ the skills of equipment specialists, contractors/procurement specialists, supply specialists, catalogers and fiscal specialists while others will be rather routine and will be handled exclusively by a provisioner with only limited contact with other functional areas.

There is no involvement of field maintenance or operational personnel in the Marine Corps provisioning process. Also, although provisioners may visit a contractor during the procedure, there is no indication that field units are visited to personally assess the maintenance and supply situation before development of a support concept and the determination of requirements. Only one weapon system acquisition in the Marine Corps in the last ten years could have qualified for the RPT method and that was the LVTP-7 (Landing Vehicle Tracked Personnel, Model 7) Amphibious Tractor Program.

b. Requirements Determination

Regardless of the provisioning method employed, the computational technique is the same. Requirements determination are made for all items including WIMM items that are authorized for procurement. During the process, special consideration is given to insurance items and numeric stockage objective items.

The Minter Criteria, DOD I 4140.42, establishes the Department of Defense policy relative to the determination of requirements for secondary item spare and repair parts, beginning with initial provisioning and continuing through DDP. The guidance in this instruction is organized in a sequence of

events that must take place during the development of initial requirements. After gross requirements are computed, the decision to stock or not to stock at the wholesale level is made based upon the execution of a basic cost equation called COSDIF.

The United States Navy decided to test the efficacy of the DOD rule (COSDIF) against an equation known as the Variable Threshold Rule [6]. The conclusions drawn from the simulation analysis conducted by the Navy's Fleet Material Support Office were:

(1) That the Variable Threshold method of range determination is more cost-effective than the COSDIF method.

(2) That, given a gross availability goal, the Variable Threshold Rule performs essentially the same as COSDIF, but with an inventory investment of 64 percent less for consumables and 42 percent less for repairables.

(3) That, given an inventory investment goal, the Variable Threshold Rule provides better performance by all measures except net effectiveness.

(4) That the Variable Threshold Rule stocks a wider range of items than does COSDIF, but to a lesser depth [6].

A description of the Variable Threshold Model is furnished in Appendix J [8]. The Navy's Ships Parts Control Center employs this technique for provisioning of items it manages because it is flexible and easy to use [8].

The Marine Corps should investigate the variable threshold method for possible application in the stockage decision.

Retail level stockage decisions and the range and depth of pre-positioned war reserve are not considered in DOD I 4140.42. The Marine Corps has developed her own rules to facilitate decision making in these two categories [25].

c. Automation of the Provisioning Process

There is currently no standardized mechanized provisioning system in the Department of Defense. Therefore, the Marine Corps has satisfied the need for an automated system by developing a provisioning process under the Marine Corps Unified Materiel Management System (MUMMS). MCLBA maintains the provisioning files for the entire Marine Corps. The provisioning files are used to record the data elements from the time the provisioning project has been established, through the period when the range and depth of repair parts support are determined, and extends until the equipment has been placed in-service. The file is used for feeding provisioning requirements into a projects requirements file and then ultimately into the master inventory file.

The Marine Corps accrues three advantages from their standardized, mechanized, provisioning processing system. First, it is convenient for the customer and the contractor to interact with the Marine Corps when they are presented with the unified system. Second, the system is faster than any manual method and encourages objective decision making. And,

third, the system is flexible enough to absorb new models, such as LORA or the Spares Optimization Model* to still further increase the efficiency and effectiveness of Marine Corps provisioning.

6. Feedback

Provisioning performance is usually measured by the frequency of complaints from operational, maintenance, and supply personnel. An attempt is also made to link provisioning performance with readiness rates. This negative feedback approach places enormous pressure on the provisioner to ensure that more than enough parts are on hand to short circuit the complaints. Without an objective method of evaluation of performance and given the condition of satisfying the customer at all expense, a condition exists for overstockage of initial support items.

7. Communication to Responsible Officials

Communication is ensured by policy and facilitated by conferences and reports. There is no obstacle for a provisioner in gaining visibility for his project or in atracting the attention of officials who have authority to make crucial provisioning decisions regarding concept and funding. This is particularly true at MCLBA.

What is absent is a Headquarters Marine Corps level committee to review and evaluate every provisioning project for

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*Spares Optimization Model (SOM) is a computerized model used to arrive at a recommended range and depth of spare parts.

effectiveness and efficiency in response to the logistic support concept envisioned for the weapon system. Decisions regarding provisioning are currently made within logistic management offices at Headquarters Marine Corps without the benefit of concurrent review with other functions.

C. PROVISIONING REFINEMENTS

1. Initial Support

Phased provisioning has been described as a selective management technique applied to new items which are susceptible to premature or excessive procurement through normal provisioning actions. The advantage of phased provisioning is to reduce the uncertainty of the need for initial support until a provisioning activity can more reliably predict requirements.

The risk associated with initial support may also be reduced, if not eliminated, by contracting out initial support and maintenance. Partial or interim contractor support is another alternative in the same category which can be effectively used until usage data is available to permit more accurate calculations of requirements.

2. Items Managed by Other Services

The emphasis in DOD on the one item - one manager concept has expanded the services' dependencies on each other for materiel support. When, during initial screening of provisioning lists it is determined that an item is established and managed by another integrated weapons manager, the Marine

Corps must submit her requirements to that WIMM via the MIPR. The MIPR has been a long standing purchasing requirement. However, there is no standard computer system interface among the services for MIPR's. As a consequence, handling is slow and priority actions sometimes are delayed beyond designated uniform military time frames for specific priority designators [16].

VI. RECOMMENDATIONS FOR ADDITIONAL STUDY

This thesis has stressed two major factors of the provisioning process. They are the risk involved in determining requirements, and the impact of provisioning on the total life cycle cost of a weapon system. Given these two inescapable parameters of risk and cost, this study attempted to identify the prevailing problems in the process.

Most certainly, the types of problems could be traced to their source. A user in the field may feel that untimely delivery and insufficient range and depth of repair parts are the main problems. The contractor may feel that the lack of specific guidance or late requests is the problem, while the provisioner may attribute the problem to provisioning technical documentation or delinquent responses to MIPR's. Thus everyone involved in provisioning has their own problems and must share in the problems common to the process.

Recommendations are made for additional investigation in the following areas:

A. The augmentation of Provisioning Project Teams.

B. The formation of an ad-hoc Provisioning Review Board at Headquarters Marine Corps.

C. The scheduling of Provisioning Review Conferences.

D. The elimination of excess stocks at the three provisioning levels through:

    1. The development of special feedback programs.

    2. The stockage of assemblies and components at forward echelons.

3. The re-evaluation of cost-to-buy, cost-to-hold equation (COSDIF).

4. An automated procedure for determination of Insurance/NSO items.

E. Contracting out of initial supply support.

RECOMMENDATION A: THE AUGMENTATION OF PROVISIONING PROJECT TEAMS

The provisioning project team should be enlarged to include additional functional elements for each new provisioning project. The authority and responsibility of the team should continue to be based on the size and nature of the project. Actual membership on the team is a management decision. However, the following key functions should be represented; a provisioner, a cataloger, a supply specialist, a contracting specialist, a maintenance specialist, and field user. The team should be responsible for making the critical decisions about maintenance factors, replacement rates, coding of items to be included in the initial stockage levels, and the development of a Provisioning Project Plan and Schedule.

The revised provisioning project team should attend all meetings requested by higher commands and boards and should continuously evaluate the project until the end of the demand development period. Close liaison should exist between the team and the weapon systems acquisition manager and logistic support elements during the entire acquisition cycle. This involvement would encourage provisioning considerations to be actively included in trade-off decisions made during the source selection process.

It is further envisioned that the team's early involvement in the weapon systems acquisition process will provide for the submission of improved PTD and lower life cycle costs.

RECOMMENDATION B: THE FORMATION OF AN AD-HOC PROVISIONING REVIEW BOARD AT HEADQUARTERS MARINE CORPS

It is recommended that the Marine Corps establish a Provisioning Review Board at the CMC level to analyze provisioning projects prior to their release. The ad-hoc board should consist of key personnel from the logistic and operating environments. The previously mentioned provisioning project team should provide the board with the rationale used in selection of items for inclusion in the initial issue package, along with justification for the critical decisions made in requirements determination. The board should also review the overall performance of provisioning projects based on data received from feedback information. In this regard, the board should evaluate the provisioning effort for efficiency and effectiveness, and for its impact on readiness and the life cycle ocst of a weapon system.

RECOMMENDATION C: THE SCHEDULING OF PROVISIONING REVIEW CONFERENCES

A review conference should be conducted at scheduled intervals following the fielding of an item with its initial support spare and repair parts. The conference attendees would evaluate the effectiveness of the provisioning effort. They should also assess the impact of changes in the operational or

support scenarios and in the configuration of the end item or a major component on the provisioning package. Their recommendations should be detailed in nature and address changes in the number and type of items stocked at the various echelons, the justification for changes in maintenance factors and SMR codes, and disposition instructions for excess parts.

RECOMMENDATION D: OVERSTOCKING

1. The Development of Special Feedback Programs

Special feedback programs should be designed to extract usage data from current maintenance and supply mechanized files. The extricated data should include actual failure and replacement rates for spare and repair parts from maintenance and support echelons. After collection, the data should be collated and analyzed against projected rates by the provisioning project teams, the CMC review boards, and the provisioning activity to compare actual usage against provisioned items' inventories.

2. The Stockage of Assemblies and Components at Forward Echelons

At forward echelons, special emphasis should be placed on stocking assemblies and components rather than a multitude of spare parts. Trouble-shooting down to the parts level is not only time consuming, but also requires special skills of maintenance personnel and built in test equipment or other diagnostic equipment which is expensive. Application of a program that reduces the growth in spare and repair parts in the supply system is consistent with lessons learned from the Vietnam War.

3. The Re-evaluation of the Cost-to-Buy, Cost-to-Hold Criteria

Consideration should be given to re-evaluation of the COSDIF equation as a method of range determination. The conclusions drawn from the computer simulations tested at SPCC indicate that there may be a more cost-effective way to determine which items should be stocked at the wholesale level of the Marine Corps Supply System.

4. An Automated Procedure for Determination of Insurance/ NSO Items

The SMR coding procedure is recognized as one of the more important steps in the initial support process. The coding reflects a judgemental and experimental decision which impacts on the cost of a weapon system through its entire life cycle. It follows that excessive coding of items as insurance or NSO can only contribute to overstockage, obsolescence of parts and generally an increase in costs.

To introduce more objective decision making into the SMR coding process, it is recommended that an automated decision matrix be developed which will code items as either insurance or NSO. This list could be reviewed by provisioners for additions or deletions so as to tailor the requirements to the needs of the operating environment.

RECOMMENDATION E: THE USE OF CONTRACTOR SUPPORT DURING THE DEMAND DEVELOPMENT PHASE

For acquisitions where the technology is untested and expensive, the Marine Corps should consider the potential of contracting out in total or partially, provisioning support.

Quite conceivably, this could be with an entity other than the end item contractor. Customarily, the end item contractor is considered the best choice for contractor provided initial support.

Two advantages are accrued by this recommendation; first, risk and uncertainty in determining provisioning support is reduced, and secondly, the spirit of OMB Circulars A-76 and A-109 are enjoined.

APPENDIX A

GLOSSARY OF KEY TERMS

1. Demand Development Period (DDP). The DDP is that period of time extending from the date of Preliminary Operational Capability (POC) to a point in time (not in excess of two years) beyond POC date when requirements can be forecast based entirely upon actual demands or other empirical data indicative of the need for spare and repair parts.

2. Insurance Item. A non-demand-based, stocked, essential item for which no failure is predicted through normal usage but if a failure is experienced, or loss occurs through accident, abnormal equipment or system failure or other unexpected occurrences, lack of replacement would seriously hamper the operational capability of a weapon or weapon system.

3. Levels of Supply.

   A. Wholesale Level. The echelon of the supply system under the direct control of the ICP which maintains quantities of stock to satisfy requisitions from the retail level.

   B. Retail Level. All echelons of supply other than the wholesale level.

4. Numeric Stockage Objective (NSO) Item. A non-demand-based, stocked, essential item for which, although failure may be predicted, the probability of demand is so low that it does not meet the stockage criteria at a given activity. Since the lack of a replacement item would seriously hamper the operational capability of a weapon or weapons system, the item is stocked.

5. Procurement Lead Time (PCLT). The sum of administrative lead time and production lead time as defined in DOD Instruction 4140.24.

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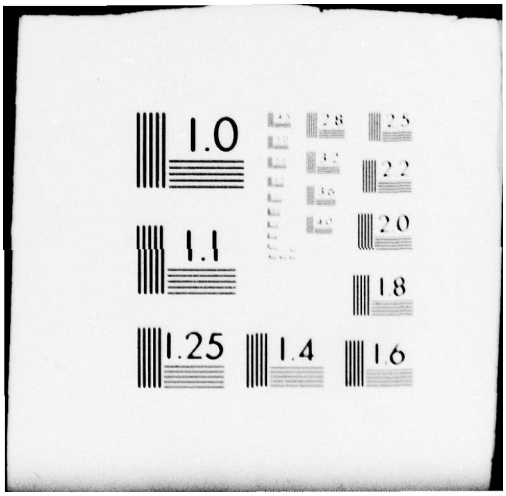

1.0
1.1
1.25
1.4
1.6
2.0
2.2
2.5

6. Program Forecast Period (PFP). The PFP represents the number of months to be used in the development of initial budget, apportionment and item requirements for spare and repair parts. The PFP is equal to the Procurement Lead Time plus a 3-month Procurement Cycle/Safety Level (PC/SL), or a minimum of 12 months, following the date of preliminary operational capability (POC) [18].
7. Program Time Base (PTB). A selected portion of the operational program beginning with the date of POC and extending to the next review cycle, or Program Period as appropriate, developed for the purpose of computing all requirements programs data.
8. Provisioning. The actions required to identify, select, procure, and properly position in the appropriate segments of the supply system and maintenance echelons, the range and depth of repair parts, tools, and test equipment, and publications required to support an item of equipment until full responsibility can be assumed by the supply system through routine replenishment.
9. Provisioning Technical Documentation (PTD). That documentation furnished by contractors to a Department of Defense activity which is used by the activity for the identification, determination of initial requirements, cataloging, and contractual formulization of items to be procured through the provisioning process. As used in this thesis PTD refers to (1) provisioning lists, (2) priced spare

parts lists and (3) electronic data processing tapes or cards.

10. Source, Maintenance, Recoverability Code (SMRC). This is a six position code. It indicates the maintenance level authorized to remove, replace, repair, assemble, manufacture, and dispose of an item; and the disposition action required for items which are removed and replaced during maintenance.

APPENDIX B

TABLE OF ABBREVIATIONS

CMC	Headquarters Marine Corps
COSDIF	Difference in cost: stocked minus nonstocked
DDP	Demand Development Period
DLA	Defense Logistics Agency
DLSC	Defense Logistics Service Center
DOD	Department of Defense
DWT	Division/Wing Team
ECP	Engineering Change Proposals
EDP	Electronic Data Processing
FBG	Field Budget Guidance
FMF	Fleet Marine Force
FYDP	Five Year Defense Program
GOL	Garrison Operating Level
GSA	General Services Administration
IAQ	Initial Allowance Quantity
ILS	Integrated Logistic Support
LAP	Letter of Adoption and Procurement
LOR	Level of Repair
LORA	Level of Repair Analysis
LVTP-7	Landing Vehicle Tracked Personnel, Model 7
MCLBA	Marine Corps Logistic Base, Albany
MPTR	Marine Corps Purchasing Requests
MIPR	Military Interdepartmental Purchase Request
MO	Mount Out
MRU	Minimum Replacement Unit
MSL	Minimum Stockage List
MUMMS	Marine Corps Unified Material Management System

NSO	Numeric Stockage Objective
PC/SL	Procurement Cycle Safety Level Quantity
PCLT	Procurement Cycle Lead Time Quantity
PFP	Program Forecast Period
PGD	Provisioning Guidance Data
PIO	Provisioned Item Order
PL	Provisioning List
PMC	Procurement Marine Corps
PPS	Provisioning Performance Schedule
PRO	Provisioning Requirement Objective
PTD	Provisioning Technical Documentation
PWR	Prepositioned War Reserve
PWRMS	Prepositioned War Reserve Material Stocks
RPT	Resident Provisioning Team
RSR	Washout Rates
SCI	Special Consideration Item
SFA	Stock Fund Account
SMR	Source, Maintenance, and Recoverability Code
SRA	Shop Replacement Assemblies
TWAMP	Time Weighted Average Months Program
VRV	Variable Risk Value
WIMM	Weapons Integrated Material Manager
WRA	Weapon Replacement Assembly
WSC	Weapon System Code

APPENDIX C

AN EXAMPLE OF TWAMP

Sample of Time Weighted Average Month's Program [18].

Program data to be used in the computation of wholesale level system stocks is based upon the time weighted average months program (TWAMP) through the program time base (PTB). The PTB is determined by the estimation of value of annual demand (VAD) as required in accordance with DOD I 4140.33. For a VAD less than $50,000 a twelve months PTB is used. For a VAD between $50,000 and $500,000 a six months PTB is used. If the VAD is greater than $500,000 a three months PTB is used. It is assumed that deliveries occur in mid-month; thus the cumulative program buildup (D_m) up to and including the last month (m) in the PTB is defined as follows:

$$D_m = I_k/2 \text{ when } m = 1 \text{ and } D_m = \left(\sum_{k=1}^{m-1} I_k\right) + I_m/2 \text{ when } m \geq 2$$

where:

k, m are month indices

I_k = number of end items placed in service during month k in the PTB

TWAMP is computed by :

$$\text{TWAMP} = \frac{\sum_{m} D_m}{\text{PTB}} ; \quad m = 1, 2, \ldots, \text{PTB}$$

Suppose, for example, the cumulative program buildup for a twelve month Program Forecast Period (PFP) is as shown below:

If a PFP of other than 12 months is recommended by MCLBA then CMC must review and approve it.

MONTH	M	J	J	A	S	O	N	D	J	F	M	A
NOS. OF MONTHS	1	2	3	4	5	6	7	8	9	10	11	12
I_K	1	2	5	10	10	10	2	2	2	1	2	1
D_m	.5	2	5.5	13	23	33	39	41	43	44.5	46	47.5

The TWAMP is now derived for different PTB's.

PTB	TWAMP
High Intensity	
3 months	$(.5 + 2 + 5.5) \div 3 = 27$
Medium Intensity	
6 months	$(.5 + 2 + 5.5 + 12 + 23 + 33) \div = 12.8$
Low Intensity	
12 months	$(.5 + 2 + 5.5 + 13 + 23 + 33 + 39 + 41 + 43 + 44.5 + 46 + 47.5) \div 12 = 28.2$

APPENDIX D

PROVISIONING REQUIREMENTS OBJECTIVE

(Initial System Stockage Levels)

SYSTEM STOCK

A. Consumable Repair Parts

(1) Provisioning Requirements Objective is equal to procurement cycle/safety level quantity (PC/SL) plus procurement cycle leadtime quantity (PCLT).

$$\text{PC/SL QTY} = A \times B \times C \times \frac{PC/SL}{360}$$

$$\text{PCLT QTY} = A \times B \times C \times \frac{PCLT}{360}$$

Where:

A = Peacetime Failure or Replacement Factor per end item per year.

B = Number of times the repair part is used in one end item

C = Number of end items authorized using units by NAVMC 1017 (Table of Authorized Material, TAM), Table of Equipment (T/E), or supported by support units or employed by an entire Marine Amphibious Force.

(2) An example

PTB = 6 months (medium intensity managed)

TWAMP = 13 (using the example in Appendix C and rounding)

A = 7.512 failure or replacement factor per end item per year

B = 2 (quantity per end item)

C = 13 end items supported (TWAMP)

PC/SL = 90 days

PCLT = 60 days

Therefore:

$$\text{PC/SL QTY} = 7.512 \times 2 \times 13 \times \frac{90}{360} = 48.828$$

$$\text{PCLT QTY} = 7.512 \times 2 \times 13 \times \frac{60}{360} = 32.552$$

And:

$$\text{Provisioning Requirements Objective} = 48.828 + 32.552$$
$$= 81.38 = 81$$

NOTE:

"C" above utilizes the TWAMP computed in Appendix C for a medium intensity managed item, while the PC/SL day level is authorized in Appendix D, and the PCLT day level is the actual PCLT.

B. Repairables

(1) Provisioning Requirements objective is equal to procurement cycle/safety level quantity (PC/SL) plus procurement lead time quantity (PCLT).

$$\text{PC/SL QTY} = \text{RR} \times \frac{\text{RCT}}{30} + \text{RSR} \times \frac{\text{PC/SL}}{30}$$

$$\text{PCLT QTY} = \text{RSR} \times \frac{\text{PCLT}}{30}$$

Where:

RR = Repair Rate - The number of times per month that an unserviceable item replaced with a serviceable item is restored to a serviceable condition through maintenance action.

RSR = Resupply Rate - The quantity of unserviceable items replaced with serviceable items expected to be washed out each month and to require replacement.

RCT = Repair Cycle Time - The time in days normally required for a repairable item to pass through the various unserviceable stages from maintenance replacement until it is restored to a serviceable condition and returned to the float.

NOTE:

The sum of the depot repair rate (RR) and depot washout rates (RSR) equals the sum of the RSR's for the Marine Corps Supported maintenance floats.

(2) An example of a depot repairable item.

PCLT = 60 days

PC/SL = 90 days

Repair Cycle Time (RCT) for depot = 25 days

RR for depot = 20

RSR for depot = 10

Therefore:

$$\text{PC/SL QTY} = 14 \times \frac{20}{30} + 10 \times \frac{90}{30} = 39.333$$

$$\text{PCLT QTY} = 10 \times \frac{60}{30} = 20.0$$

And:

Provisioning Requirements Objective = 39.333 + 20.0
= 59.333 or 59

(3) An example of a repairable item anticipated to be disposed of below the depot level of maintenance.

PCLT = 60 days
PC/SL = 90 days
RCT for depot = Ø
RR for depot = Ø
RSR for depot = 15 (the sum of RSR's for all floats supported).

Therefore:

$$\text{PC/SL QTY} = 0 \times \frac{0}{30} + 15 \times \frac{90}{30} = 45.0$$

$$\text{PCLT QTY} = 15 \times \frac{60}{30} = 30.0$$

And:

Provisioning Requirements Objective = 45.0 + 30.0 = 75.0

APPENDIX E

Initial System Stock Operating Level

A. Marine Corps Managed Consumables and Repairables are authorized 90 days (PC/SL) plus a PCLT [25]. The following conditions apply:

1. When the computed 90 day (PC/SL) initial provisioning requirements quantity for an already established Marine Corps Managed item is considered significant, the demand base for that item will be increased by the provisioning estimate; and the requisitioning objective will be recalculated. The provisioning estimate will be based on a 90-day (PC/SL) and will not include PCLT.
2. If computations fail to authorize stockage, a limited quantity of critical code 1 items may be stocked for insurance purposes. However, if the item is stocked as an insurance item at the retail level, no system stock is authorized. Insurance items may be stocked at retail or wholesale level, but not at both levels.
3. Numeric Stockage Objective (NSO) items may be stocked in retail and system stock.
4. Initial System stock of Marine Corps Managed items will be protected from disposal during the 2-year DDP. If no usage is recorded for the item during DDP, the protection period will be extended an additional 2 years.

B. Items managed by other service agencies are not authorized.

APPENDIX F

COSDIF MODEL

$$\text{COSDIF} = (F_o/F_d)[C + 2HU(R+Q)] \quad (1)$$

$$+ (1-F_o/F_d)[C_p(D/Q) + HU(S+Q/2) + C_I F_d] \quad (2)$$

$$- (1-F_o/F_d)[KC_p F_d + PDU + F_d L \text{ MAX}(LAG*\lambda*F_d)] \quad (3)$$

Where:

F_o/F_d	=	Probability of zero demand in coming two years, given annual frequency of demand F_d.
C_p	=	Cost to Procure
H	=	Holding Cost Rate
U	=	Item unit price
R	=	Reorder level
Q	=	Economic order quantity
D	=	Forecast of annual demand
S	=	Safety level
C_I	=	Cost of Issue
F_d	=	Annual frequency of demand
K	=	Conversion factor to adjust procurement costs for nonstock items
P	=	Increase in item unit price due to spot buy
L	=	Procurement Lead Time
λ	=	Shortage Cost
LAG	=	Production Lead Time

In part one of the COSDIF formula the probability of no demand in two years (DDP) is multiplied by the expected cost to hold that item in inventory for two years.

In part two the probability of demand in two years is multiplied by the holding cost for that item for one year.

In part three the probability of demand in two years is multiplied by the expected annual cost of not stocking the item and needing it.

APPENDIX G

Marine Corps Provisioning Decision Matrix for Initial System Stock

Matrix Variables

RD = Replenishment Annual Demand Rate

U_p = Unit Price

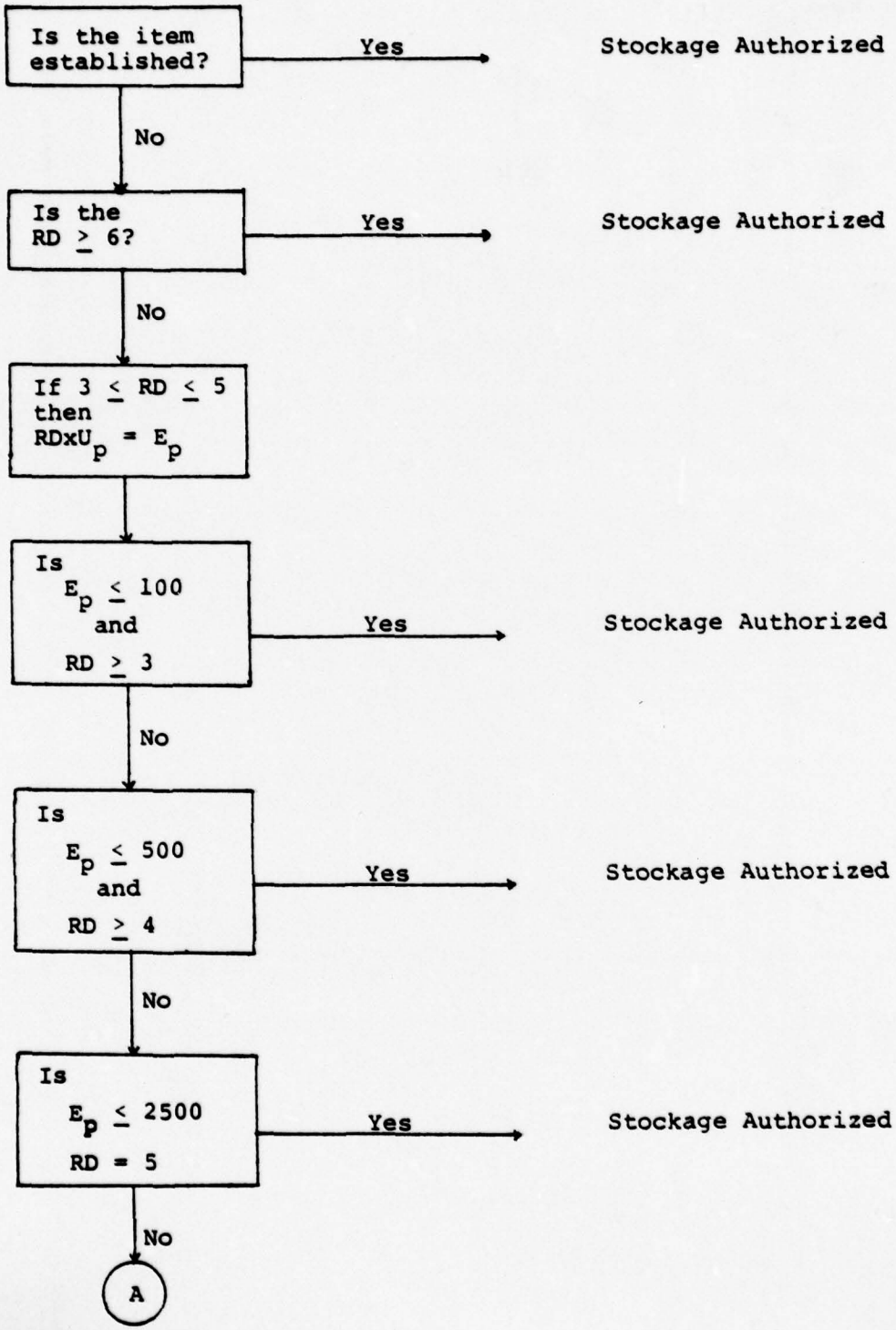
E_p = Extended Price

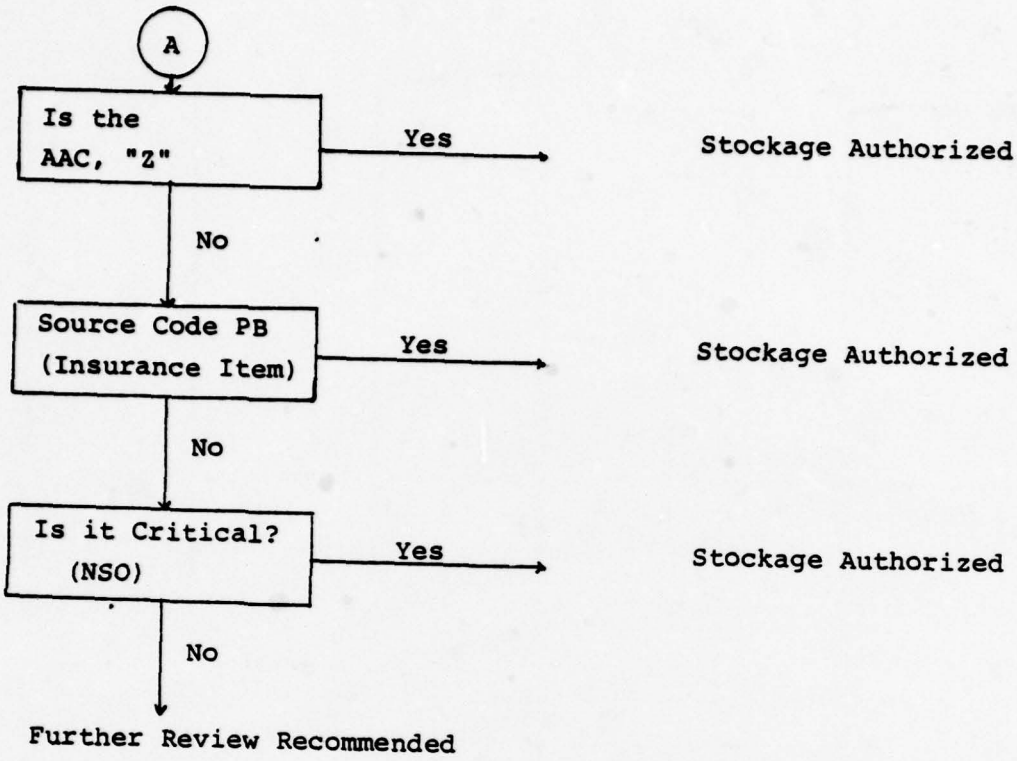
AAC = Acquisition Advice Code

"Z" = AAC. Explanation follows: Centrally procured and stocked in nominal quantities only due to the essentiality or lead time of the item.

PB = Source Code of SMR. This designates an insurance item.

NSO = Non Stockage Objective Item


Is the item established?
Yes
Stockage Authorized
No
Is the RD ≥ 6?
Yes
Stockage Authorized
No
If 3 ≤ RD ≤ 5 then RDxU_p = E_p
Is E_p ≤ 100 and RD ≥ 3
Yes
Stockage Authorized
No
Is E_p ≤ 500 and RD ≥ 4
Yes
Stockage Authorized
No
Is E_p ≤ 2500 RD = 5
Yes
Stockage Authorized
No
A


A
Is the AAC, "Z"
Yes
Stockage Authorized
No
Source Code PB (Insurance Item)
Yes
Stockage Authorized
No
Is it Critical? (NSO)
Yes
Stockage Authorized
No
Further Review Recommended

APPENDIX H

INITIAL ALLOWANCE QUANTITY
(Garrison Operating Level and Mount Out)

Initial Allowance Quantity [25].

A. Initial Garrison Operating Level (GOL). The initial GOL of repair parts for using and support units will be based on predicted consumption within authorized day levels.

(1) Consumables Repair Parts:

a. The total quantity stocked initially is equal to the quantity of repair parts required during the average cumulative order and shipping times of using and support units.

$$\text{GOL QTY} = A \times B \times C \times \frac{OST}{360}$$

Where:

A = Peacetime Failure or Replacement Factor per end item per year

B = Number of times the repair part is used in one end item.

C = Number of end items authorized using units by NAVMC 1017 (Table of Authorized Material TAM), Table of Equipment (T/E), or supported by support units or employed by an entire Marine Amphibious Force.

$\frac{OST}{360}$ = Cumulative average order and shipping time in days

All fractions are dropped

b. The following example was extracted from MCO P4400.79C. The equation is applied to a repair part, such as a wheel bearing roller with the following results:

A = 0.5, authorized for removal and installation at organizational level maintenance.

B = 4

C = 112

OST = 120 days.

Therefore:

$$GOL = .5 \times 4 \times 112 \times \frac{120}{360} = 74.7 = 74$$

Distribution of the 74 parts would be as follows, according to the SMR code.

	OST	QTY
"O" (Organizational Part User)	30 days	6
Third Echelon Supporter	30 days	6
Fourth Echelon Supporter	60 days	10
"F" (Third Echelon Part User)	30 days	6
Third Echelon Supporter	60 days	10
Fourth Echelon Supporter	60 days	10
"H" (Fourth Echelon Part		
Fourth Echelon Supporter	120 days	26
	360 days	74

(2) Repairable Items. All initial repairable items are placed in a maintenance float. Assets are then segregated into operating and mount-out assets.

a. The stockage objective for each float is computed as follows:

$$GOL = (RR \times \frac{RCT}{30}) + (RSR \times \frac{DL}{30})$$

Where:

GOL = Initial Garrison Operating Level for a maintenance float.

RR = Repair Rate - The number of times per month that an unserviceable item replaced with a serviceable item is restored to a serviceable condition through maintenance action.

RSR = Resupply Rate - The quantity of unserviceable items replaced with serviceable items expected to be washed out each month and to require replacement.

RCT = Repair Cycle Time - the time in days normally required for a repairable item to pass through the various unserviceable stages from maintenance replacement until it is restored to a serviceable condition and returned to the float.

DL = DAY LEVEL - The authorized initial secondary repairable item float levels expressed in days.

To arrive at the authorized levels the Maintenance Replacement Rate (MRR) is also computed.

$$MRR = \frac{A \times B \times C}{12} = RR + RSR$$

Where:

A = Peacetime Failure or Replacement Factor per end item per year

B = Number of times the repair part is used in one end item

C = Number of end items authorized using units by NAVMC 1017 (Table of Authorized Material, TAM), Table of Equipment (T/E), or supported by support units or employed by an entire Marine Amphibious Force

b. A sample computation is provided for MRR and GOL float. Let

A = 6.426 failure/replacement factor per end item per year

B = 1 used per end item

C = 325 end items supported in continental United States

DL = 30 days as authorized by Appendix A to MCO P 4400.79C.

RR = 24.74

RCT = 22 days

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RSR = 2.92

Support Period = 180 days

(1) $MRR = \frac{6.426 \times 1 \times 325}{12}$ = RR + RSR

MRR = 174.03 = RR + RSR

(2) $GOL = (24.74 \times \frac{22}{30}) + (2.92 \times \frac{30}{30})$

GOL = 18.14 + 2.92 ≈ 21.06 = 21

B. Initial Mount Out (MO). MO is held by using and support units. It is expressed as 60 days of combat consumption and is not based on OST.

(1) Consumable Repair Parts

a. Mount out stocks will be computed against the following equation, for using and support organizations (3rd and 4th echelon). A 60 day level is authorized for those items for which predicted consumption is one or more during the first 60 days of combat for active forces (inactive forces will be authorized a 30 day level).

$$MO = A \times B \times C \times \frac{60}{360}$$

b. If the predicted combat consumption of a critical support item fails to compute to one in the total of prepositioned war reserves plus mount out, then MO is recomputed as follows:

$$MO = A \times B \times C \times \frac{360}{360}$$

No more than one will be stocked as a result of this computation; it will be stocked as an NSO item.

c. Critical repair parts for low density equipment will also be authorized for stockage at the 4th echelon support units mount out.

d. Using the values provided in A(1)b herein a computation is made.

$$MO = 0.5 \times 4 \times 112 \times \frac{60}{360} = 37.3 = 37$$

(2) Repairable

a. The stockage objective of each mount out float is

$$MO = (RR \times \frac{RCT}{30}) + (RSR \times \frac{60}{30})$$

b. A sample computation using the variable values provided in A(2)b follows:

$$MO = (24.74 \times \frac{22}{30}) + (2.92 \times \frac{60}{30})$$

$$= 18.14 + 5.84 = 23.98 = 24$$

APPENDIX I

Prepositioned War Reserves

Prepositioned War Reserve [25].

A. Consumables

(1) PWR is a segment of the total prepositioned war reserve material stocks (PWRMS) issued to the active forces. For an initial PWRMS a computation will be made for each Marine Amphibious Force (MAF) and the 4th Marine Division/Wing Team. The equation follows:

$$\text{PWRMS} = A \times B \times C \times \frac{\text{Support Period (days)}}{360 \text{ days}}$$

Where:

A = Peacetime Failure or Replacement Factor per end item per year.

B = Number of times the repair part is used in one end item.

C = Number of end items authorized using units by NAVMC 1017 (Table of Authorized Material, TAM), Table of Equipment (T/E), or supported by support units or employed by an entire Marine Amphibious Force.

Support Period = 180 days for 2nd and 3rd MAF, 150 days for 1st MAF and 90 days for 4 DWT.

The initial resupply level or PWR level for each MAF would thus be constructed as:

$$\text{Resupply} = \text{PWRMS} - \text{MO}$$

Where:

PWRMS = Value computed above.

MO = Value computed in Appendix G, para. B(1)a.

(2) An example of the computation follows:

A = 0.5

B = 4

C = 112

Support Period = 180 days

Therefore:

$$\text{PWRMS} = 0.5 \times 4 \times 112 \times \frac{180}{360} = 112$$

and

$$\text{MO} = 0.5 \times 4 \times 112 \times \frac{60}{360} = 37$$

thus

Resupply = 112 - 37 = 75

B. Repairables

(1) Each MAP resupply is based on an established resupply rate (RSR).

$$\text{Resupply} = \frac{\text{Supported Period (days)} - 60 \times \text{RSR}}{30 \text{ days}}$$

Where:

Support Period (Days) = Same as A(1) above

RSR (-Resupply Rate) = The quantity of unserviceable items replaced with serviceable items expected to be washed out each month and to require replacement.

(2) A sample computation is provided. Let:

Support Period = 180 days

RSR = 2.92

Therefore:

$$\text{Resupply} = \frac{180 - 60 \times 2.92}{30} = 11.68 = 12$$

APPENDIX J

Variable Threshold Technique

The Use of the Variable Threshold Technique Involves the following steps [8].

STEP 1 DETERMINE THE VARIABLE THRESHOLD VALUE FOR EACH ITEM SELECTED AS A CANDIDATE FOR STOCKAGE.
(This value is equal to the items probability of at least one demand during the procurement lead time divided by its unit cost.) The Variable Threshold formula is provided in attachment 1 to this appendix.

STEP 2 LIST THE VARIABLE THRESHOLD VALUES IN DESCENDING ORDER.

STEP 3 DETERMINE AN UNCONSTRAINED DEPTH QUANTITY BASED ON THE PROCUREMENT LEAD-TIME DEMAND AND A PARTICULAR ASSUMED DEMAND PROBABILITY DISTRIBUTION.
(A normal distribution is used when annual demand is equal to or greater than twenty. For annual demand between one and twenty, a negative binomial distribution is used. The Poisson distribution is used for annual demand of one or less.)
The process starts with the calculation of the variable risk value (VRV) for each item. VRV equals an items holding cost divided by the sum of its holding cost and an essentially - weighted shortage cost. This risk is assumed to be the probability of a stockout during lead time when the item is stocked initially to the desired depth quantity. The depth quantity is then determined by comparing the risk value with probabilities of

stockouts obtained from the assumed probability distribution. This unconstrained depth quantity is constrained to be no more than 2 years demand if consumable or, no more than procurement lead time plus one quarters demand if repairable.

STEP 4 SELECT THE ITEMS TO BE STOCKED.

(Select the insurance items first. The insurance items will be stocked in quantities of minimum replacement units (MRU) as established by PTD. Subtract the value of the insurance items from the funding constraint. Select the items at top of list developed in Step 2 and begin subtracting the extended value from the funds remaining after the subtraction of the insurance items. This process continues until all the funds are consumed or all the items listed are exhausted.)

STEP 5 ITEMS NOT SELECTED AS INSURANCE ITEMS OR SELECTED BY THE VARIABLE THRESHOLD TECHNIQUE WILL NOT BE INITIALLY STOCKED.

The Variable Threshold Equation:

$$P = \frac{1 - e^{-DL}}{C}$$

Where:

P = probability that one or more demands will occur during a leadtime per dollar invested

D = forecast of quarterly demand

L = leadtime in quarters

C = unit price

e = Napier's number (2.71828).

(ATT 1 APP J)

APPENDIX K

DETAILED ELEMENTS OF PROVISIONING TECHNICAL DATA

B = 4

C = 112

OST = 120 days.

APPENDIX K [21]

1. Sequential Line Item
2. Indenture Numbers
3. Reference Symbol Number
4. Item Name
5. Prime Contractor's Part Number
6. Quantity per Assembly
7. Quantity per Component
8. Quantity per End Item
9. Shelf Life
10. Total Quantity Recommended/Ordered
11. Unit Price
12. Extended Unit Price
13. Source, Maintenance, Recoverability Code
    (Government usually inserts but may be inserted by the contractor if the provisioning activity requests)
14. Stock Number
15. Item and Lot Number
16. Federal Manufacturers Code
17. Manufacturers Part Number
18. Recommended Maintenance Quantity/Factor
    (Quantity or wearout, replacement or failure factor applicable to maintenance)
19. Recommended Overhaul Quantity/Factor
    (Quantity or wearout, replacement or failure factor applicable to overhaul)
20. Useable Code
21. Optional
22. Spares Allocation

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